University of Alberta

Computer and Internet Usage among Canadian Orthodontists

by

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A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Science

In

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Abstract

An anonymous, self-administered, mail-out survey of Canadian orthodontists was conducted to evaluate computer and Internet use as well as the use of other computer related equipment. The survey collected information in three sections: demographic information, office computer use, and perceptions and attitudes regarding digital and electronic technology.

The response rate was 45.58% (304/667).

Orthodontists' computer use is very high (97.4%) and almost three quarters of orthodontists have Internet access at work. While computers are used for a variety of tasks, administrative tasks are the most common use for computers in orthodontists' offices.

While Internet access in general is quite high among orthodontists, younger orthodontists appear to have Internet access more often than their older colleagues. In addition to this, offices with more staff and which started more cases had Internet access more often than their counterparts.

Orthodontists generally felt that digital and electronic technology was useful for and capable of improving the way they practiced orthodontics. The majority of orthodontists were willing to use the technology in a variety of applications. The major obstacles to the general use of the technology are related to cost, security or privacy, and time.

Preface

This thesis document describes a research project designed to investigate the use of digital and electronic technology by Canadian orthodontists. The material is presented in five chapters. Chapter 1 is a review of current and historical topics related to the research and outlines the purpose and objectives of the project. It contains a review of literature in order to inform the reader the issues facing digital and electronic media usage in health care and orthodontics. Chapters 2, 3, and 4 have been written as independent papers prepare for submission for publication in orthodontic journals. The final chapter, Chapter 5 is a summary of the results of the projects and provides insight into some of the limitations of the study and some potential for future research in the area.

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List of Abbreviations

Abbreviation	Meaning
AAO	American Association of Orthodontists
ADA	American Dental Association
ANSI	American National Standards Institute
CAD/CAM	Computer Aided Design/Computer Aided Manufacturing/Milling
CAO	Canadian Association of Orthodontists
CDA	Canadian Dental Association
DICOM	Digital Imaging and Communications in Medicine
DSL	Digital Subscriber Line
EDI	Electronic Data Interchange
GDP	General Dental Practitioner
GP	General Practitioner
ISDN	Integrated Services Digital Network
StatsCan	Statistics Canada
UK	United Kingdom
US	United States of America
WWW	World Wide Web

Chapter One

Introduction and Literature Review

1.1 - Computers

Over the past 20 years computers have penetrated the offices of orthodontists in North America. Their implementation in the practice of orthodontics involves tasks ranging from bookkeeping, to scheduling, to charting, and to image manipulation. As the computer age has raged on, the profession has adopted much of what it has to offer. Some of these applications have met resistance, some of them have been graciously accepted, and some of them have been thrust upon the profession. As a result of the rapid change in the computer industry, there is much disparity in the acceptance and the implementation of new technology. The experience of one orthodontist is not the experience of another and thus we see differences in the attitudes and trends associated with information technology. Some question the relevance of some applications while others wonder how they ever got along without it. As the profession moves on it is unarguable that the computer and its related telecommunication capabilities will be a part of the practice of orthodontics in some way or another. It is important that as a profession we come to an understanding of where the profession stands in regards to current trends in computer usage as well as what the current attitudes of its members are in regards to this type of technology. This requires a study of the demographics of the population to obtain descriptive data and to develop profiles which can be correlated and compared to usage and attitude patterns. Once the current status of the profession is determined we will be better equipped to effectively use digital and electronic media in accomplishing our goal of providing care to our patients and communities in an efficient and effective manner.

1.2 – Computer Jargon

Since the day computers were first used for health care applications, enthusiasm has grown for the capabilities that they offer. The ability to provide health care at a distance to another site and the ability to access and disseminate information quickly and efficiently are only two of the things which the technology has to offer. As health care professions began to apply computer technology new terms were developed to describe the application of computers to health care delivery.

"Telemedicine is the combined use of telecommunications and computer technologies to improve the efficiency and effectiveness of health care services by liberating caregivers from traditional constraints of space and time empowering consumers to make informed choices in a competitive marketplace." [1] In more simple terms, it can be defined as, "the use of electronic information and communications technologies to provide and support health care when distance separates the participants." [2] As telemedicine has slipped into the medical disciplines it has naturally spilled into the dental and dental specialty fields. The use of telehealth in the dental and dental specialty professions has broad applications. Some of these applications include video conferencing, e-mail referral and consultation, digital photography, digital radiography, the Internet, and online continuing education.

Since 1999, a new term, e-health, surfaced to encompass health services delivered using the Internet. [3] E-health in and of itself is not separate and distinct from telehealth. It simply offers a more universally accepted network, the Internet, over which telehealth applications can be performed. In general terms, e-health refers to health care delivery using electronic media over the Internet. It can encompass any service including informational, educational, administrative, educational, clinical, and commercial. Lastly, e-health is not professional centered. That is to say, it can involve professionals, nonprofessionals, business, or consumers themselves. Because of the universal accessibility of the World Wide Web (WWW) over the Internet, consumers or the general public have access to much of what e-health has to offer [4]. More recently, the term "Tel-e-health" has emerged as a catch-all for any health care computer application.

1.3 - Computer and Internet Use

Computers have changed the way we live in almost every aspect imaginable. The computer has become an integral part of North American society and may some day be as common as the telephone. Over the past two decades, computers have gone from being a specialty item in homes and offices to being a necessity item [5].

Similarly, the health care professions have accepted computers in the delivery of health care.

> "It is over three decades since information technology was first introduced to primary [health] care. In the 1960s its use centered on collating patient data; in the '70s the possibility of electronically linking primary and secondary care emerged; in the '80s computers were introduced to the consulting room; and in the '90s the internet provided the potential to obtain and review useful information during the consultation. After 30 years of analyzing the "potential" benefits of computers, perhaps we should allow information technology in primary care to mature. In the 21st century we should accept that the computer is a useful tool. Rather than continually describing its capabilities, research must move forward to evaluate key outcomes for patients, practices, and the health service as a whole [6]."

At present, there has been no research into computer and Internet use specific to the orthodontic population. Neither has there been any research available specific to computer use among Canadian dentists in general. Comparative information has been compiled through research investigating computer usage among American dentists and the medical profession, which has similarities to the dental profession. Canadian and U.S. general population information technology utilization has been evaluated through the Canadian census and U.S. census information.

The American Dental Association (ADA) Survey Center [7] has been compiling information on computer usage of its members since 1984. The Survey Center has compiled their information using mail out surveys to its membership on approximately a three or four year basis. As can be expected the results of the survey show dramatic increases in dentist computer usage over the past two decades.

In 1984, only 11% of American dentists had computers in their offices. This amount rose to two-thirds by 1994. By the year 2000, the date of the latest available survey data, the number of dentists with computers in their office was 85%. The survey also looked at the age of the dentist to evaluate a correlation between computer usage and age. The older age groups are less likely to have computers in their primary office and this decline in computer use begins in the 50-54 age group and shows a steady decline into the 65 and older age group. The greatest amount of

computer use in 1994 was seen in the age group 35-39, where 80% of dentists reported having an in-office computer. [7 8]

As might be expected, dentists are not the primary computer users in an office. Since 1984, secretaries/receptionists have consistently accounted for over 60% of the primary computer users. In fact the number of offices in which the dentists had been the primary computer user has declined from 10% in 1984 to 4% in 1994.

1.4 - Orthodontic Office Computer Applications

Computers have the ability to form a myriad of tasks, which are commonly referred to as applications. In 1986, 2750 dentists in Los Angles and Pennsylvania counties were surveyed. It was concluded that computer usage was experiencing only a slow amount of growth and that they were primarily being used for administrative purposes [9].

Information obtained from the ADA Survey Center indicates that dentists use computers for numerous applications. In 2000, almost all of the respondents reported using computers for patient accounting and billing (96.4%) and processing insurance forms (93.1%). Almost three-quarters of the dentists used computers for maintaining expense records (72.5%) and for scheduling patients (73.7%). The 2000 survey reported slight increases in these categories when compared to the 1997 survey. When clinical applications were considered, half of the dentists used computers for maintaining treatment records (51.8%) and only 40.4% used computers for diagnosis and monitoring of treatment [7 10]. These results illustrate that although computers have seen an increased acceptance in the dental profession, general use of computers in a clinical application has not been as common as administrative applications.

1.5 - Orthodontic Offices and the Internet

The Internet has, in some instances, made access to information, products, and services instantaneous. The Internet has also provided an immediate and an efficient way of transferring information, the boundaries of which are only limited by

accessibility to an Internet connection. It is this universal accessibility that has allowed for the greater versatility and the wider applicability of e-health.

In March 2001, Statistics Canada looked at several factors related to Internet usage among the Canadian population. A telephone survey was conducted of a sample of Canadians aged 15 or greater to obtain information regarding Internet information communication technology in the past 12 months. This data was then grouped and compared to socio-economic factors [11].

When Internet use was compared to age, the greatest percentage of use was among the group from age 15-24 at 85.6%. While approximately two thirds of the 25-44 age groups used the Internet, only 18.7% over 55 years of age reported using the Internet in the past 12 months. In addition to this, in every age group males reported a higher percentage of Internet use than females.

The data also suggest that education and household income have a significant relationship to Internet usage. There is quite a large discrepancy in Internet usage between those who have a university degree or who have had some university or college education (83.1% and 71.2%) compared to those who have a high school diploma or who have not completed high school (44.7% and 34.3%). Similar results are seen in regards to household income in that homes with a household income greater than $80,000 have a much greater number of Internet users (80.6%) than homes with a household income less than $30,000 (33.4%). Urban locations (59.3%) had more Internet users than did rural locations (44.4%).

In general, 53% percent of Canadians over the age of 15 responded that they had used the Internet in the past 12 months. This demonstrates quite a significant increase from 1994 when only 18% of Canadians were using the Internet.

The report determined that the characteristics of a Canadian Internet user tend to be younger, male, more educated, more affluent, and urban dwelling. This coincides with other sources which state that those using the Internet are highly educated, relatively affluent, and predominantly middle aged [4]. Furthermore, this is in agreement with U.S. Census Bureau statistics, which also concluded that Internet users tend to be younger, male, more educated, more affluent, and metropolitan dwelling [12].

When Canadian orthodontist Internet usage is viewed in light of the information obtained from Statistics Canada and the U.S. Census Bureau, one would assume that the percentage of users would be relatively high. To become a certified specialist in orthodontics requires extensive post-secondary education which will typically provide an income in a middle class to upper-middle class [13] and the majority of practicing orthodontists are males who reside in urban locations [14]. This would lead one to believe that the potential for Internet usage among Canadian orthodontists would be high.

In light of research regarding Internet usage among American dentists, Canadian orthodontists would be expected to have a high percentage of users. In 2000, 85.6% of American dentists had access to a modem at work compared with only 69.1 % in 1997 and 61.7% in 1995. Over half (56.4%) of dentists surveyed by the ADA in 2000 reported having access to the Internet at work and 90.6% had access at home. There was a slight decrease (45.7%) in Internet access amongst the 60 and older group and a slight increase (61.3%) in the age group under 40. Amongst those who reported that they did not have Internet access, 49.3% reported no plan to get Internet access.

In regards to high-speed Internet access (i.e. DSL, cable, etc.), 9.9% of dentists reported having high-speed Internet in 2000. While this may appear to be a small amount, 41.1% of dentists reported that they planned to get high-speed Internet access with the next year and another 13.6% planned to get it in more than one year. In addition to this, the universal availability of high-speed Internet service is a relatively recent occurrence and the survey was conducted prior to that time.

1.6 - Websites

Statistics Canada information reports that 21.7% of Canadian enterprises have a Web site. The 2000 ADA survey of dentists' computer usage reports that 18.1% have a Web site on the Internet. Web sites tended to be age related as the under 39 group reported the greatest amount of Web sites (24.5%) and the 60 and older reported the least (15.2%). Of those who reported having a Web site, the main purpose of the service was for consumer information (98.9%) and advertising revenue

(59.3%). It is quite likely that since 1999 the number of enterprises in Canada and the number of dentists in the U.S. with Web sites have increased [7 15].

1.7 – E-mail Communication

One of the simplest, greatest and most widely used Internet services available is electronic mail (e-mail). For many, e-mail has become a part of their daily life. E-mail in its simplest form consists of sending an electronic message from one person to another via Internet lines. This form of telecommunication has become popular because it has several advantages over the traditional means of communication such as the telephone and the traditional postal service. Some of these advantages are: [16]

- Often, the transmission time is very short and relatively independent of the distance to the recipient.
- Sending e-mail is free once Internet access has been established.
- Distributing documents to more than one recipient is an easily accomplished, one-step procedure.
- E-mail conserves natural resources consumed during the production and distribution of paper mail.
- Recipients can store copies of e-mail messages on their hard drives.
- It is possible to include files in binary format (i.e. MS Word documents or digitized images) when sending e-mail. Duplication on disks and subsequent distribution by mail is unnecessary.
- It is possible to copy all or part of existing documents into e-mail messages and vice versa
- Based on the short transmission time, e-mail is more akin to a real-time conversation than a delayed information exchange.
- E-mail can be sent 24 hours a day at the convenience of the sender and then read at the convenience of the recipient.
- Provides a record of the communication, which can be stored and then retrieved at one's convenience.

Unfortunately, not every thing about e-mail in the orthodontic setting is advantageous. There are some unique disadvantages to this method of

communication, which may have significantly slowed its general acceptance and use in the profession. Some of the disadvantages include: [4]

- Slower rate of communication than verbal communication face-to-face or over the telephone.
- Restriction of verbal and non-verbal cues to assist in communication makes e-mail ambiguous, which can render diagnosis and treatment planning impossible.
- Privacy and patient confidentiality concerns due to lack of security of e-mail or Internet-based communication in general.
- An increased potential for data base corruption due to computer viruses.

E-mail is one of the most frequently used Internet services available. It is simple to use, inexpensive, and in many instances an efficient means of communication. Its acceptance has been increasing rapidly over the years and it is being used by more and more people [17]. In 2000, 46.7% of survey respondents in Canada reported using e-mail [11]. Among Canadians who use the Internet about 84% connect to e-mail, and many use it daily. Just over 4 million e-mail users, about 39% of total users, reported that they used e-mail every day in the past month. Another 25% said they used it at least several times a week [18]. In the United States, E-mail is the most common Internet application at home, used by 88 percent of adults and 73 percent of children who are online [12].

Among our professional counterparts in dentistry and even in medicine, e-mail service is becoming an important means for both doctor-doctor and doctor-patient communication. In a survey of New Jersey physicians, 55% reported using e-mail [19]. Other reports show that there has been a dramatic increase in e-mail use among physicians from only 15% in 1996 to 70% in 1998. It can be assumed that the number of physicians using e-mail to communicate with each other and with patients has continued and will continue to increase [20 21]. According to the 2000 ADA survey on Dentists' Computer Use, 76.1% of dentists use the Internet at work for e-mail communication. Once again this is suggestive of the similarities in computer and telecommunication technology usage between the medical and dental communities.

1.8 - Videoconferencing

Perhaps the grandest form of telehealth lies in videoconferencing. This is a synchronous type of communication in which people at two remote locations are able to communicate via audio and visual media which is captured using a digital video camera and transmitted over telecommunication lines. [22] By way of definition, videoconferencing is "Two-way transmission of video images among multiple locations in real time to bring people at physically remote locations together for meetings and teleconsultation [4]."

Not until recently has videoconferencing been an option for general use over the Internet. Traditionally the demands of videoconferencing were too great for dial-up connections and required an Integrated Services Digital Network (ISDN). Due to expense and lack of accessibility to ISDN lines videoconferencing was all but impossible for the orthodontic practitioner. With the arrival of greater bandwidth and "High Speed" Internet services the possibility of conducting real-time videoconferencing in an orthodontic and/or dental setting has greatly increased.

Other specialized equipment, beyond adequate connection lines, is also required for video conferencing. Some of this equipment, such as whiteboard facilities and media players, is already contained in some current operating systems and is thus available to most orthodontists with up-to-date computer equipment. But additional equipment required can include a digital video camera, audio equipment, and/or videoconferencing software [22]. Videoconferencing is the hallmark of telemedicine and as the abilities of personal computers increases and as improvements in software and image manipulation improve it will be exciting to see what will become of this type of telecommunication.

1.9 - Perceptions and Attitudes

Implementation of new technology requires not only that the technology is able to meet its objectives in providing a service but it also requires that the population for which the technology was created be comfortable with it and willing to use it. The greatest new piece of equipment or technology will never obtain general acceptance if the marketplace does not view it as useful or valuable. In order for

digital and electronic information utilization to increase among orthodontists, there must be an associated perception and attitude, such that they equate value to the technology.

A 2001 survey of Canadian dentists was conducted for the Canadian Dental Association (CDA) to help determine Canadian dentists' priorities in regards to funding support for various research areas [23]. Due to the low response rate (16%) extrapolation of the results to the general Canadian dental population is not reliably accurate. Nevertheless, the three areas respondents identified as being the highest priority were: evaluation of the effectiveness of techniques and treatment (77%), development of treatments (76%), and development of materials (70%). Those categories considered least important included improvements in access to care (42%) and better understanding patient behavior (25%). Among the orthodontists who responded to the survey (2.6% of respondents), periodontal disease, orofacial and dental pain, and composites and other restorative materials (other than amalgam) were considered to be the highest research priority.

Table 1.1

Dental research priorities identified by orthodontic practitioners
(% of respondents with 95% confidence intervals)

Research Items	Percentage of respondents	95% confidence intervals
Periodontal disease	47	33-61
Orofacial and dental pain	33	20-47
Composite and other restorative materials	29	16-42

Validity of the results to the orthodontic specialty is obviously suspect as the survey was for the most part constructed as a tool for research in dentistry in general. It is unlikely that the questionnaire had response options specific to the orthodontic specialty. But in light of this study, research into telecommunications and related computer applications is likely a low priority to the dental community.

The best chance for acceptance of a new product will be if it can be used to solve issues related to the practice of orthodontics, which are viewed as being the most important to the practitioner. The greatest source of concern and stress to orthodontists are issues related to time-management and patient cooperation. In addition to this, the least satisfying aspects of orthodontics are practice management and lack of personal time issues [14]. Therefore, if the product were able to improve on these aspects of the practice of orthodontics then it would provide value to the consumer. For example if telecommunications and computer technologies could make more efficient use of practitioners' time it might improve their practice management skills and provide them with more personal time.

Unfortunately, many perceive new technology as an increase on an already demanding workload. Because of the associated learning curve and the potential lack of comfort with current computer technology many, particularly individuals who are older, view the implementation of new technology as something that will decrease efficiency. Some may see no reason for change because the traditional method is working fine. This creates a barrier to the integration of electronic and digital information usage. Many physicians find that the time commitment involved in learning and using computers is too great, resulting in additional stress.

> "Most practitioners willingly accepted computers as part of their working environment and were positive about their use. Many thought that computerised records were more accurate than conventional records or that they improved patient care. Patients said that computers gave their doctors better access to records and that consultations were unaffected. However, five themes emerged that could prove major barriers to successful implementation of computers: privacy, the doctor-patient relationship, cost, time, and training.
>
> Loss of privacy and confidentiality was the commonest concern to patients. Many thought that computerised notes posed a greater threat to privacy and were more vulnerable to unauthorised access than conventional records, and should therefore be restricted to non-sensitive information. One study found that some patients were unwilling to be completely frank about their problems in front of doctors using computerised records and would consider changing to another doctor.
>
> Both practitioners and patients were concerned about the possible negative impact of computers on the doctor-patient

> relationship. This concern was partly due to the logistics of incorporating a computer in the consultation and partly to the perception that computers would take over the doctor's role.
>
> Costs of computerisation were considered prohibitive, both by practitioners and patients. Many doctors said that the time commitment involved in learning and using computers was too great and was more than they had expected, resulting in additional stress. Finally, existing training in computer use was perceived as being poor, and it was thought that this should be made a component of doctors' continuing medical education." [6]

In 2002, a survey of UK orthodontic consultants was conducted regarding teledentistry conferencing to provide orthodontic advice to general dental practitioners (GDP). Nearly two-thirds of the consultants were interested in providing an electronic diagnostic service to their local GDPs while only 20% were not interested. When asked about patients obtaining orthodontic advice electronically directly from a central facility or through a GDP referral the orthodontic consultants were less interested (26% and 50%). The results also showed that there is interest in developing this area of orthodontics, as 70% were in favor of further research into providing orthodontic advice by electronic means [24].

It must be noted however that the UK structure for dentistry and orthodontics is a federal government supported service whereby orthodontists' services are paid through the public health system. Consequently, the need to centralize the service helps to reduce costs by decreasing demands on orthodontic consultant's time. Because of a shortage of orthodontic specialists in the UK, a remote orthodontic advice service might help reduce inappropriate referrals and provide GDPs with access to advice, which would enable them to treat a broader range of orthodontic cases by themselves [25 26] In North America, where dental services are fee for service based and supported only by private insurance providers, the idea of a centrally located consultation service for general dentists is not yet and may never be feasible.

When the opinion of the GDPs was solicited, the results suggested that teledentistry was a viable means for obtaining orthodontic advice. Live video-link consultations were not thought to be essential and that asynchronous communication was sufficient. The major obstacle identified was the time it took to prepare the case material. This became a source of negative opinions particularly when the time to

prepare the case for a teledentistry conference took more time than conventional means [25 26].

As has been previously noted, younger practitioners and younger people in general take to computer technology much more readily than do older people. This may be because youthfulness permits people to better adapt and accept new technology and implement it into their lives. The assumption can be made that as one ages it makes one less willing and/or less able to grasp onto the concepts and skills necessary to properly implement new technology. On the other hand, perhaps the reason younger individuals use computer technology more readily is because they have gone through their developmental years using the technology and it is therefore not considered "new" to that generation. The older generations may not see a need to use the "new" technology as they perceive that their current methods are satisfactory.

Even within the relatively short academic experience of dental school, changes in the attitudes and experiences of dental students regarding informatics and computer applications have been documented. At the University of Pennsylvania, surveys of three dental classes (1988 III year, 1990 III year, and 1990 II year) showed an increase in personal computer ownership from 5.9% in the 1988 III year class to 26% in the 1990 II year class [27]. A related survey conducted in 1990, regarding computers and dental informatics, evaluated knowledge, opinions, and experience of first- and fourth-year dental students [28]. Little difference was noted between the groups. All of the groups reported having little computer knowledge and experience, but reported positive opinions towards the subjects. These results indicate that there exists a need to provide more instruction in general computer application and specific dental informatics, particularly at a time when positive attitudes suggest a readiness and willingness to accept the technologies [29].

A survey of trends in students' knowledge, opinions, and experience regarding dental informatics and computer applications was conducted using the first- and fourth-year dental classes of 1990 and again in 1993 [29]. Data was then organized into four knowledge sub-scores which included hardware, software, electronic communications, and dental applications. A significant increase in first-year computer ownership ($p < 0.001$) from 17.9% in 1990 to 43.8% in 1993 was observed.

The rest of the characteristics relating to computer knowledge, opinion, and computer experience showed no statistically significant difference between the 1990 and 1993 first-year classes. When comparing 1990 and 1993 fourth-year classes there were no statistically significant differences in computer ownership but the 1993 class reported twice as much computer knowledge (7.8 vs. 14.1; $p < 0.001$) and computer experience (41.6 vs. 55.6; $p < 0.001$). Most notable was the difference in information access and retrieval applications, where the 1993 fourth-year class reported nearly twice as much experience. It is however noted that the 1993 fourth-year class had received an information management course, which the 1990 fourth-year class did not.

When first-year students in 1990 were re-surveyed in 1993 as fourth-year students, computer ownership had increased from 15.3% to 21.2% but the differences were not statistically significant. An increase of nearly twofold was seen in every computer knowledge characteristic. A statistically significant increase in mean computer experience from 41.7 to 55.4 ($p < 0.001$) was measured [29].

1.10 - Obstacles & Strategies for Future Implementation

There are many issues facing the generalized use of digital and electronic media in orthodontics. Some of these issues have become significant obstacles, which have slowed its general acceptance in their respective professions. To meet the needs of the population of orthodontic specialists, it is necessary to identify implementation obstacles and their attitudes toward these obstacles.

New methods and technologies have an associated learning curve. In a study conducted by the US Army, resistance was found from a senior dentist to the application of telehealth consultation. The researchers suggested that better methods for technology integration in the treatment room might make it more attractive for such clinicians. Regardless, this method of proactive referral, where the referrer is responsible for collecting diagnostic information, places greater demands on the referring clinician. This can be perceived as simply burdensome, but in some instances and personalities, it can be perceived as threatening. These sociological elements have been observed in telemedicine at large as well [30].

It is generally accepted that the computer is a common and perhaps necessary piece of equipment in an orthodontics office. As such, orthodontists must take initiative by becoming comfortable in the electronic world. They must begin by understanding not only how their practices will be affected by the digital transformation of health care, but also how they and their patients can benefit from appropriate development of teledentistry [31]. By establishing current trends in the usage of computers, the Internet, and digital and electronic media it will better equip the profession for future implementation of this technology. It will assist practitioners in knowing where they stand in comparison to the rest of the profession so that they can investigate continuing education possibilities as well as technological updates to their practices.

There are pros and cons to any application of a new technology. As these are reviewed and compared, evaluating the cost-benefit and risk-benefit of the technology can help make decisions concerning its implementation. It is obvious that there will be obstacles that will need to be overcome. E-health with everything that it has to offer faces several significant obstacles to its general usage in the orthodontic and dental professions. Some of these obstacles include [4 32 33]

1. Inadequate quality of Web-based information
2. E-health often is expensive and time consuming
3. Inter-participant software incompatibility,
4. Patient privacy issues
5. Unclear association and governmental regulations,
6. Interference with the patient-practitioner relationship,
7. Unclear fee for service or remuneration guidelines
8. Lack of acceptance for reimbursement by insurance providers

In orthodontics, there currently are no standards for image and record quality for electronic or digital information. For example, there is no minimum requirement for radiographic image quality in relationship to pixel size and/or compression or file size. The American National Standards Institute (ANSI) has developed standards digital imaging and communications in medicine (DICOM), which defines a format for storage and exchange of digital images, including radiographic and visible-light

images. DICOM is the American standard in the medical profession for the managing of images. Although some dental radiology vendors have begun to implement DICOM standards, by and large they have not been universally accepted in the dental profession [34].

In 1992 there was interest in the standardization of clinical information systems. After evaluating current informatics activities, a Task Group was created by the ADA to initiate the development of technical reports, guidelines, and standards on electronic technologies used in dental practice. The Task Group included the following five working groups for clinical information systems:

- Dental practice systems
- Diagnostics, clinical peripheral devices, and software
- Electronic data interchange (EDI)
- Computer based patient record interfaces
- Dental education and research systems

The working groups were established to promote the concept of a dental computerized clinical work station and to allow the integration of different software and hardware components into one system. Clinical information systems include all areas of computer-based information technologies such as digital radiography, digital intraoral video cameras, digital voice-text-image transfer, periodontal probing devices, and CAD/CAMs, etc. By establishing standards for these modules, the need for several stand-alone systems in the dental office will be eliminated. Each subcommittee has been researching standards already in existence to determine if they could be applicable to dentistry. Participants are also interested in interfacing with standards groups active in medicine informatics [35]. Unfortunately, despite 11 years of effort, no firm standards have been put forward by the committee.

Another obstacle to the quality of e-health communication is the degradation of information during transmission and the loss of information inherent with the media. Questions arise during the compression and extraction of a file, which may result in degradation in the quality of the image. For example, how will the image be translated into an electronic image? Will the image need to be compressed in order to be transmitted? What amount of image quality can be lost before it becomes

clinically significant? Was the image recorded from a digital camera or radiographic machine, or was it a scanned copy of an existed photo or radiograph? Is software between the two participants compatible and able to accurately represent the true image? The individual using the images to make a diagnostic judgment must contemplate all of these questions. Ultimately the responsibility to obtain accurate records in order to develop an accurate diagnosis and treatment plan remains the sole responsibility of the practitioner [36]. As such, users must understand the limitations of this media so that decisions can be made to abort a teleconsultation in favor of conducting a traditional person-to-person consultation. E-health may never completely replace face-to-face contact with a patient or colleague.

Diagnosis and treatment planning in orthodontics routinely involves the use of plaster study models to assist in visualizing the patient's malocclusion. Study models in plaster have been difficult to digitally reproduce. In the event that it becomes necessary to photograph models it is best accomplished using a well-lit room with a dark background. Recently, technologies (E-models©, OrthoCAD©) have been developed which allow for models to be scanned and then reproduced in a digital computer file. Software is then used to view and to manipulate the models for the purpose of maintaining records and for assisting in diagnosis and treatment planning.

The advantages of this type of technology are many. They include: elimination of model breakage and storage problems, instant retrieval of models, ease of communication with patients and colleagues, and model access from many locations. It enables the orthodontist to e-mail images if desired and is a convenient presentation tool. In addition to this they provide a means of maintaining a consistent quality for creating a digital reproduction of the patient's occlusion. The major disadvantages include lack of tactile input for the orthodontist, time needed to learn how to use the system, and the cost to use the service [37]. As this service has only been available for the past few years, it has not carved a large niche in the orthodontic market as of yet. Time will tell what the future holds for this promising technology.

1.11 - Objectives

Research Objectives:

Objective #1: To develop a research tool for gathering data relative to the use of digital and electronic information in the Canadian orthodontic community.

Objective #2: To determine the present frequency and type of digital and electronic information technology and applications currently being used by Canadian orthodontists.

Objective #3: To determine the current attitudes and perceptions relative to the use of and benefits of digital and electronic information in the Canadian orthodontic community.

Objective #4: To determine the technological capabilities of the Canadian orthodontists with respect to using digital and electronic information.

Objective #5: To determine present and potential obstacles to the use of digital and electronic information specific to Canadian orthodontists.

Objective #6: To obtain information relative to the practice of telehealth in order to assist in the development of future strategies and technologies for the improvement of the practice of orthodontics.

1.12 – Research Questions and Hypotheses

#1 – What is the frequency of computer and Internet use among orthodontists?

#2 – What are computers and the Internet primarily used for in orthodontic practices?

#3 – How does computer and Internet use among orthodontists compare to the dental profession and to the general public?

#4 – Is there a statistically significant association between orthodontist's age or experience and Internet use?

HO – There is no significant relationship
HA – There is a significant relationship

#5 – Is there a statistically significant association between orthodontic practice location and Internet use?
HO – There is no significant relationship
HA – There is a significant relationship

#6 – Is there a statistically significant association between orthodontic practice size and Internet use?
HO – There is no significant relationship
HA – There is a significant relationship

#7 – What are orthodontists' perceptions of the capabilities of digital and electronic media to improve the practice of orthodontics?

#8 – What are orthodontists' perceptions of how useful digital and electronic media is to the practice of orthodontics?

#9 – What are orthodontists' attitudes towards using digital and electronic media in the practice of orthodontics?

#10 – What are orthodontists' perceptions towards obstacles to the use of digital and electronic media in the practice of orthodontics?

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Chapter Two

Canadian Orthodontists' Computer and Internet Use

Orthodontists' Computer Use

2.1 - Introduction

Computers are present in almost every facet of the modern world. By the year 2000, computers had penetrated approximately half of the homes in Canada and in the United States [1 2]. The use of computers in a business setting even exceeds that of home use. A 1999 survey of Canadian enterprises revealed that in 81.9% used computers [3].

From 1984 to 2000, dental offices have seen a steady increase in computer usage from 11.0% to 85.1% [4]. From 1996 to 1997, an Internet-administered survey of dentists and dental support staff revealed that 78% of the respondents have computers in both their home and office, 13% only have home computers, 7% only have office computers, and only 2% did not have a computer in either their home or office [5]. While one would assume similar trends would be seen in the orthodontic population, no research has ever been undertaken to develop an accurate view of where the community stands in regards to the usage of computers and computer equipment.

The Internet has also had increasing acceptance since the introduction of the World Wide Web in 1993 [6]. A telephone survey of Canadians aged 15 and older conducted by Statistics Canada in 2000, revealed that approximately 13 million, or 53% of Canadians used the Internet at home, at work, or at some other location in the past 12 months.[7] A 2002 Ipsos-Reid Internet trends report revealed that 75% of Canadians have access to the Internet and that 63% of adults have access at home. This compares with the 55% of Americans with household Internet access [8]. The U.S. Census Bureau in 2000 reported that 41.5% Americans had access to the Internet [2] and dentists in the U.S. reported an even greater amount of Internet access at home than the general public (90.6%) [4].

Computers have the capability to perform a wide range of applications. In 1986, the results of a survey of 2750 dentists in Los Angles and Pennsylvania counties concluded that only a slow growth in computer usage could be expected. In addition to this, dentists primarily limited their computer applications to administrative tasks [9] The information obtained from the ADA Survey Center[4] indicates that there has been a steady increase of computers in dental offices with the

greatest increase seen between 1990 and 1994. With respect to computer functions, in 2000 administrative functions continued to be the main tasks for which computers were used [4].

The objectives of this study were:

1. To evaluate the presence of computers in orthodontic offices.
2. To determine the tasks computers are being used for in the orthodontic profession.
3. To evaluate Internet access and Internet use in the orthodontic profession.
4. To descriptively compare computer and Internet use to the general public and to the dental profession.

2.2 - Methods

2.2.1 - Survey Instrument

A mail out questionnaire was developed as a research tool to survey the orthodontists in Canada. The survey was designed to obtain information related to the usage of computers and the Internet in the practice of orthodontics. The survey was divided into two components: demographic and practice characteristics and office computer usage. Office computer usage questions were developed to evaluate primary computer users, imaging software, charting methods, computer applications, computer equipment, digital photography and radiography capabilities, and Internet connection.

The initial survey was developed by the thesis committee, which consisted of 2 practicing orthodontists, an informatics consultant, and a sociologist. Questions were compiled and arranged in order to assist in obtaining the information relevant to the topic. Upon completion of the survey development phase, a draft survey was distributed to three practicing orthodontists of varying age and practice demographics who acted as a pilot group. Based on the feedback obtained, minor revisions were done in order to produce the final draft. The study protocol was approved by the Health Research Ethics Board at the University of Alberta (Appendix A) and the final version of the survey is provided in Appendix B.

2.2.2 - Survey Distribution

A mailing list of Canadian orthodontists was compiled from the 2003 provincial regulatory bodies. Two orthodontists were excluded because they had

been involved in the development of the research tool. The remaining 687 orthodontists became the sample population for the study.

The survey questionnaires were distributed in a packet, which included a return self-addressed stamped envelope and an introduction letter (Appendix C) to explain the research topic and to obtain informed consent from the participating orthodontists. Two weeks and three weeks following the initial mail out of the packet, reminder cards (Appendix D) were mailed to the sample population thanking them for their participation or reminding them to complete the questionnaire and to return the survey.

Thirty-four mail-out packets were returned to sender due to incorrect addresses. Other means of obtaining correct addresses such as AAO and CAO web-site directories were checked in order to obtain up to date addresses. Of the 34, updated addresses were located for 14 orthodontists and these were redistributed by mail. The individuals for whom no current address was available were considered not to be practicing and were removed from the sample population. The total number of surveys received by orthodontists came to 667.

2.2.3 - Data Analysis

The surveys were coded and spreadsheets created for data entry. The survey results were manually entered into a personal computer. The data was cleaned by checking for any entries outside of the legitimate range or inconsistent codes and the necessary corrections were made by manually rechecking the surveys. The data was then analyzed using SPSS 11.5 for Windows (SPSS Inc., Chicago, IL). Using a random number generator, 20% of the surveys were selected and hand checked by a third party to determine the rate of data entry errors. The data entry error rate was 0.103% (12 of 11651 points) which was determined to be low enough to consider the remaining data accurate enough to forego further manual confirmation.

The data was analyzed using descriptive statistics. No attempt was made to make statistically significant inferences, as frequency and range were the methods used to report results in previously published research [247].

2.3 - Results

Of the 667 surveys available for data collection, 304 were collected for data entry, which produced a response rate of 45.58%. Of the respondents, 9 were in "full-time academic" positions, 17 reported as "not practicing", and 278 orthodontists reported that they were currently practicing. A summary of key demographic data is located in Table 2.1. Comprehensive data describing the characteristics of the survey respondents is presented in Appendix E.

Computer usage

The number of orthodontists with computers in their office was reported to be 97.4%. This suggests that the vast majority of orthodontists use a computer at work in some way.

Figure 2.1 reports the responses to questions concerning hardware computer components. Respondents reported that 90.3% have a CD-ROM, 81.1% have a color printer, 75.5% have digital photography, and 66.5% have a scanner. Slightly over half reported having a CD writer and only 14.5% reported having digital radiography.

The primary functions of computers in orthodontic offices were mostly administrative tasks. Respondents reported that computers were primarily used for: accounting/billing/bookkeeping (92.2%), scheduling (82.8%), communicating with patients (73.1%), processing insurance claims (61.9%), and digital imaging (61.2%) (Figure 2.2).

Internet usage

When asked about modems and Internet connections, 74.9% of the orthodontists reported having a modem and 74.0% reported having Internet access in the office. An additional 12.4% reported that they accessed the Internet from a different location. Of those who reported having Internet access at work, 36.2% reported having a "dial-up" connection and 63.3% reported having a "broadband or high-speed" (DSL, cable, etc.) connection Figure 2.3. One in ten of the respondents who currently had a dial-up connection reported that they would be upgrading to "broadband" in the next 12 months while only 12.7% who currently had no Internet access planned to get Internet access within the next 12 months.

One quarter of the orthodontists (24.9%) reported not having Internet access at work. Figure 2.4 shows the respondents' reasons for not having in office access to

the Internet. Almost one half (47.5%) reported that they *accessed the Internet from a different location*. Almost 4 out of 10 reported having *security or privacy concerns* related to the Internet. Other reasons for not having Internet access were that they had *no need* and that they had *no interest*, 26.2% and 21.3% respectively.

Figure 2.5 shows the orthodontist's uses for the Internet at work within the last 3 months. The primary uses of the Internet among the respondents were to use e-mail or World Wide Web (65.8%), to obtain product support or information (61.4%), to read electronic journals (42.9%), to buy dental products (39.8%), and to participate in continuing dental education (30.4%). Less than a quarter of orthodontists reported having an office web site.

2.4 - Discussion

Just under half of the orthodontists in Canada responded to the survey. Due to the low rate of orthodontists who did not have computers in their office (only 7 orthodontists reported not having computers) correlative statistical information could not be obtained. Fortunately, response rates of almost 50% can allow for some inferences to be made in regards to the general orthodontic population of Canada.

The descriptive data suggests that a broad range of practice locations and characteristics are represented in the data. Despite the survey not having been translated into French, the response rate from Quebec (41/123 or 33.3%) was only slightly lower than the total response rate (304/667 or 45.6%) and was almost equal to the response rate from Ontario (100/292 or 34.2%). Therefore, it can be assumed that the sample of respondents is representative of the practicing orthodontic population in Canada.

The percentage of orthodontists who have in office computers is 97.4%. This indicates that approximately 20 orthodontists in all of Canada do not have computers in their office. Orthodontists in Canada use computers more than other Canadian enterprises when compared to 1999 statistics (81.9%) [3]. It should, however, be expected that the amount of computer use in the public sector, in general, has increased over the last 4 years. The ADA reported that in 2000, 85.1% of dentists had computers in their dental office; a percentage which has steadily increased since 1984 when only 11.0% of dental offices had computers. The ADA also reported that

of the dentists, who did not have a computer in 2000, 57.6% were planning to purchase one. Extrapolation of these results to the Canadian orthodontic population may indicate that less than 10 orthodontists in Canada do not currently have a computer and have no plans on purchasing a computer.

The primary reason for which orthodontic offices have a computer included: *accounting/billing/bookkeeping*, *scheduling*, and *communicating with patients*. The findings are similar to the ADA results in that 96.4% of dentists reported using computers for "patient accounting and billing" and 73.7% reported using computers for "Scheduling patients." Conversely, only 61.9% of orthodontists used computers to process insurance forms while 93.1% of dentists used computers for this same task [4].

Three quarters (74.9%) of orthodontists have a modem at work. When compared to the 2000 ADA survey, which reported that 85.6% of dentists had a modem-equipped computer at work, this is quite a bit lower than what might have been expected. When considering Internet access, the opposite pattern was seen whereby 74.0% of Canadian orthodontists reported having Internet access at work while only a little over half of the dentists in America, in 2000, reported the same access. In addition to this, only 52.8% of Canadian enterprises used the Internet thus indicating that orthodontic offices in Canada are high consumers of Internet services [3]. Obviously, consideration must be taken into account for the fact that there is a difference of 3 years between the time of this survey and that of the ADA [4]. When comparing orthodontist's Internet use to the general public, orthodontist's were more likely to have Internet access [2 7].

High-speed or broadband Internet has increasingly changed the way many of us live. It is likely that it has also changed orthodontic office practices. It would appear that the orthodontic community has accepted high-speed Internet providers as the acceptable form of Internet service, given that 63.3% currently have a broadband connection and an additional 10.2% indicated that they would be upgrading to broadband in the next twelve months. The results of the ADA survey report a staggering difference in broadband use. Only 9.9% of dentists reported having broadband and only an additional 31.1% planned on getting the service within the

next twelve months. In fact, 55.3% reported that they had no plan to get high-speed Internet access. Canadian access to broadband Internet connection has been reported to be among the highest in the world and was reported to more than double that of their North American counterparts [8]. Once again though, the data from the ADA is somewhat confusing on this issue of broadband service, as the availability of broadband service became generally available around the time the survey was conducted in 2000[4].

One quarter of orthodontists reported having no in office Internet access; half of which reported having access to the Internet at another location. This seems consistent with ADA results, which in 1997 and 2000 showed a slightly higher amount of Internet access at home than at work. The main reasons orthodontists did not have access to the Internet included *security or privacy concerns* (37.7%), *no need* (26.2%), and *no interest* (21.3%). Based on these results it would seem that the major impediments to the Internet are not due to inaccessibility, cost, or lack of computer skills [4].

Canadian orthodontists tend to use Internet resources less than the American dentists do. Dentists used the Internet more to purchase products, read electronic journals, and to e-mail. The exceptions to this were that more Canadian orthodontists had office Web sites (23.0%) and participated in online dental discussion groups (15.0%). It is reasonable to assume that the difference in office Web sites is also due the 3-year difference in the time at which the two surveys were conducted. One would assume that more dentists would have Web sites today than in 2000 [4].

2.5 - Conclusions

- Computer use amongst orthodontists is high (97.4%), but there still exist a small number of orthodontic offices without computers.
- The primary use for computers in an orthodontic office is for administrative tasks (accounting/bookkeeping and scheduling) rather than clinical tasks.
- Internet access is quite common and high-speed Internet is becoming increasingly more common among orthodontists.

- The main reasons for not having in office Internet access include security or privacy concerns or that the orthodontist has no need for or interest in the service.
- Orthodontists' office web site use is similar to that of dentists and private enterprise.
- Internet use among orthodontists is greater than that of the general North American public.

2.6 – Chapter 2 Tables and Figures

Table 2.1: Key demographic data of survey respondents.

Characteristic	*n*	
Age	268	Mean - 47.4 years SD – 9.3 years
Years practicing orthodontics	274	Mean – 15.9 years SD – 9.4 years
Province of primary practice	275	
British Columbia	58	21.1 %
Alberta	46	16.7 %
Saskatchewan	6	2.2 %
Manitoba	9	3.3 %
Ontario	100	36.4 %
Quebec	41	14.9 %
New Brunswick	6	2.2 %
Prince Edward Island	1	.4 %
Nova Scotia	8	2.9 %
Newfoundland	0	0 %
Population of community of primary practice	275	
Less than 100,000	99	36.0 %
100,000 - 499,999	65	23.6 %
500,000 – 999,999	69	25.1 %
1,000,000 or more	42	15.3 %
Primary type of practice	284	
Solo Practice	186	65.5 %
Associateship – associate	23	8.1 %
Partnership	27	9.5 %
Group Practice	38	13.4 %
Academic	9	3.2 %
Other	1	0.4 %

Total n varies due to non-responses. Maximum total $n = 284$

Figure 2.1

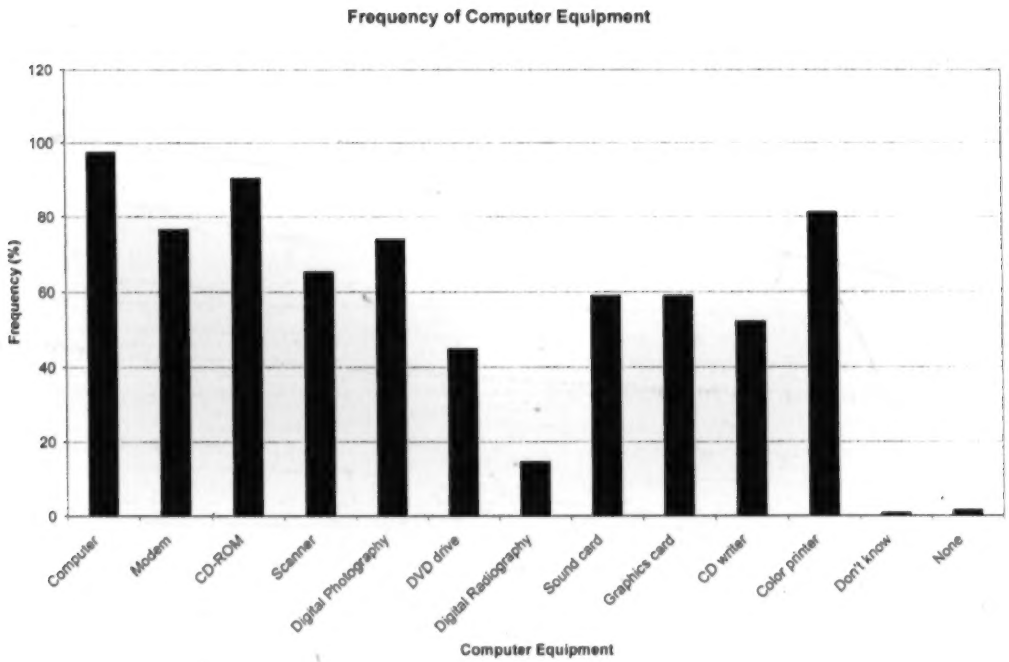


Figure 2.2

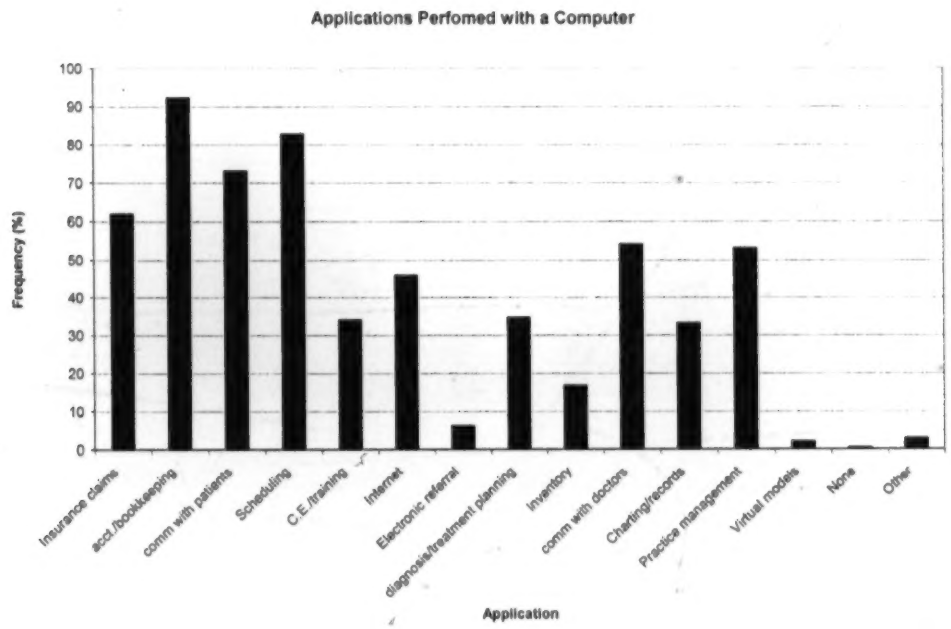


Figure 2.3

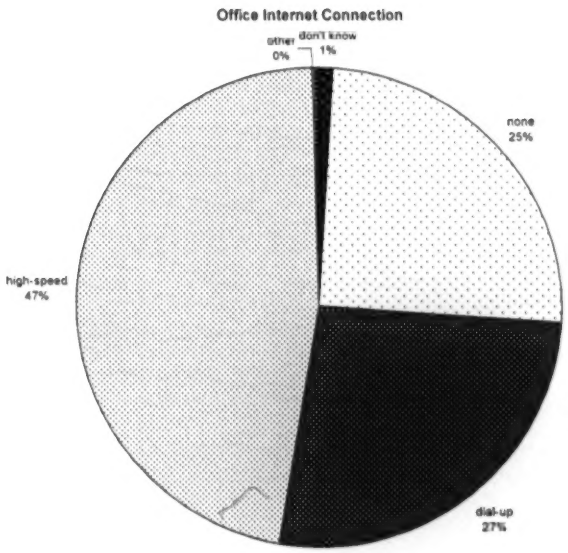


Figure 2.4

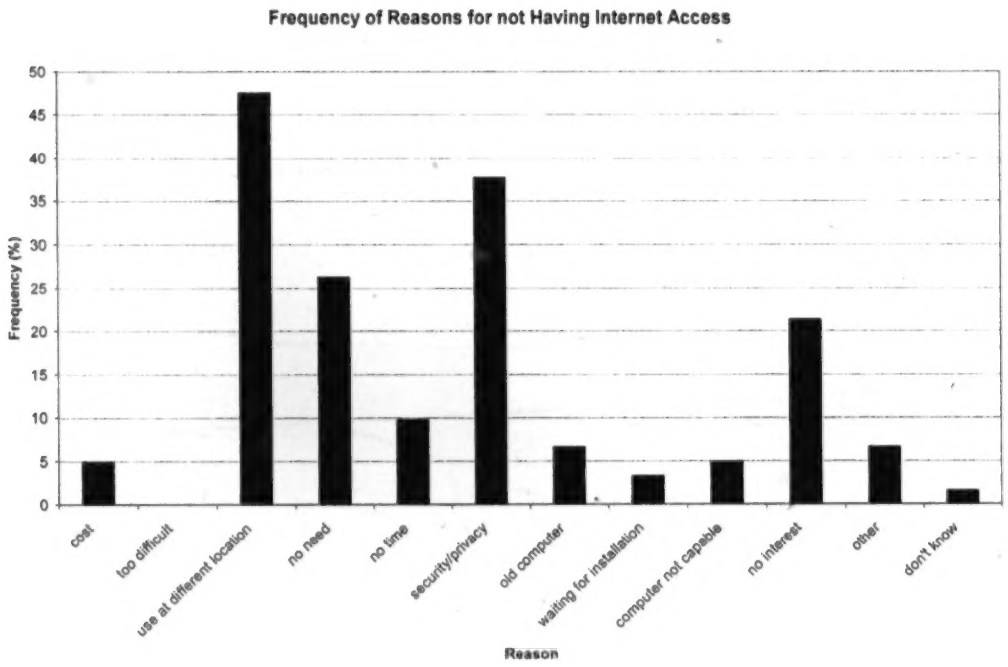
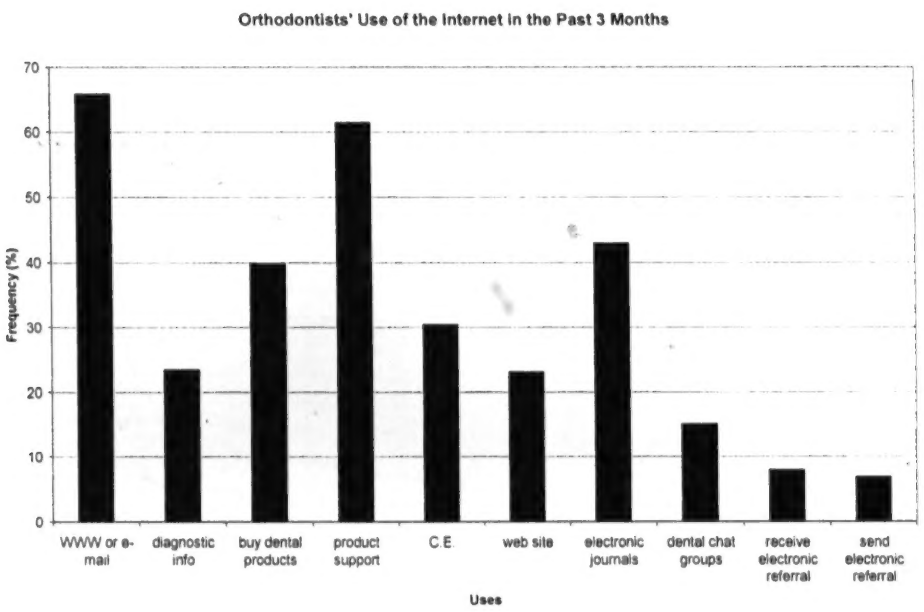


Figure 2.5


Orthodontists' Use of the Internet in the Past 3 Months
Frequency (%)
70
60
50
40
30
20
10
0
WWW or e-mail
diagnostic info
buy dental products
product support
C.E.
web site
electronic journals
dental chat groups
receive electronic referral
send electronic referral
Uses

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Chapter Three

Canadian Orthodontist Internet User Profile

Profile of an Internet user

3.1 - Introduction

Over the past few decades, a dramatic rise in Internet use in contemporary society has occurred. The Internet can be found in many of today's homes and offices. During this period of escalating Internet use, effort has gone into identifying characteristics of those who use the service. As the characteristics and current habits of Internet use are determined, strategies can be made for development and implementation of current and future technology.

There is currently no information available specific to Internet use by orthodontists. Therefore, sources of information other than the immediate sample population are required in order to have a base line against which the data can be compared. Statistics Canada and the U.S. Census Bureau indicate that in 2000, almost half of the households in North America had access to the Internet at home. Surveys of American dentists show that in 2000, 92.4% had access at home and 85.6% had access at work [1 2].

The Internet has become the source of a wealth of information. Because of its potential, understanding who the users are helps to increase the service it can provide. Descriptive research has shown that there are certain characteristics of Internet users. Factors such as: education, household income, age, and location are used to establish profiles of Internet users and non-users.

Age has become a common identifier of Internet use. The general trend is that Internet use decreases with age. As is commonly seen, younger generations more readily implement and apply new technology. Surveys of the North American population have revealed that Internet use peaks in the late twenties to early forties [1 2]. Because of the length of time it takes to obtain an education as a certified specialist in orthodontics, one would expect that those who have recently graduated would fall in the 30 to 40 years of age range. Therefore, they would be more likely to have Internet access than those at the end of their careers. This is seen among dentists who reported that 85.7% of dentists under the age of 39 had Internet access at work while 67.1% of dentists over the age of 60 had Internet access at work [3].

As previously mentioned, an orthodontic education takes numerous years of post-secondary or university education. With the typical 2-4 years of general studies, 4 years of dental school, and 2-3 years of orthodontic specialty training, the minimum amount of post-secondary education for a certified specialist in orthodontics would be 8-10 years. Educational attainment is a factor which has been linked to Internet use. It would be expected that orthodontists would be more likely than the general North American public to have access to the Internet. U.S. and Canada census information reports that 66.0% and 83.1% of individuals with a bachelor's degree or a university degree had access to the Internet at home. Dentists in the U.S. reflect the correlation between greater amount of post-secondary education and Internet access as 92.4% reported having Internet access at home and 85.6% reported having Internet access at work[1,2].

About 8-in-10 family households in the U.S. with annual incomes of $75,000 US or more had at least one individual who accessed the Internet from home. In contrast, only about 2-in-10 U.S. families with household incomes below $25,000 US had Internet access [2]. In Canada, 80.5% of family households with a household income of $80,000 CAN or more had at least one Internet user. Only 32.8% of family households with a household income of less than $30,000 CAN had at least one Internet user [1]. An American Dental Association (ADA) survey of American orthodontists and dentofacial orthopedists revealed that the average net income from the primary private practice in 1998 was $223,730 [4]

The objectives of this study were:

1. To obtain information regarding office characteristics relative to Internet use among orthodontists
2. To compare the socio-economic information for orthodontists to the North American public with regards to Internet use
3. To develop a profile of an Internet user in the orthodontic profession

3.2 - Methods

3.2.1 - Survey Instrument

Canadian orthodontists were surveyed using a mail out questionnaire. The purpose of the survey was to obtain information related to computer usage and of

digital and electronic technology usage in orthodontic offices in Canada. Two sections were developed and consisted of: 1) demographic and practice characteristics and 2) office computer usage.

The demographic and practice characteristics surveyed included practice type, birth year, years of orthodontic practice, practice location, number and type of staff, computers in practice, hours of practice, and yearly case starts. The number of offices who reported having Internet access in their primary practice office determined office Internet usage.

The initial survey was developed by the thesis committee (2 practicing orthodontists, an informatics consultant, and a sociologist) to identify relevant issues pertaining to the use of the Internet in orthodontic offices. Questions were developed in order to gather information relevant to the use of the Internet in an orthodontic office. A pilot group consisting of three practicing orthodontists of varying age and practice demographics then reviewed a draft survey. Feedback was obtained from the pilot group and minor revisions were made in order to produce the final draft. The research protocol was approved by the Health Research Ethics Board at the University of Alberta (Appendix A). The final version of the survey is located in Appendix B.

3.2.2 - Survey Distribution

The provincial registries for 2003 were obtained in order to develop a mailing list of Canadian orthodontists. Two orthodontists were excluded from the mailing list due to their involvement in the development of the research tool. The remaining 687 orthodontists became the sample population for the study.

The survey questionnaire, a return self-addressed stamped envelope and an introduction letter (Appendix C) to explain the research topic and to obtain informed consent from the participating orthodontists were compiled into a packet and distributed. A reminder card (Appendix D) was mailed out one week and three weeks after the initial mail out. The reminder cards were sent to the sample population in order to thank them for their participation or to remind them to complete the questionnaire and to return the survey.

Incorrect addresses resulted in 34 mail-out packets being returned to sender. The AAO and CAO web-site directories were checked in order to attempt to obtain up to date addresses. Of the 34 returned to sender, updated addresses were located for 14 orthodontists and the survey packets were redistributed. If a current address could not be obtained for the individual they were considered not to be practicing and were removed from the sample population. The total number of surveys mailed to orthodontists was 667.

3.2.3 - Data Analysis

The surveys were collected and responses were entered into pre-coded spreadsheets. The data was cleaned by checking for any entries outside of the legitimate range or inconsistent codes and the necessary corrections were made by manually rechecking the surveys. The results were manually entered into SPSS 11.5 for Windows (SPSS Inc., Chicago, IL) and were prepared for data analysis. A random number generator was used to select 20% of the surveys. These were then hand-checked by a third party for errors. From this a rate of data entry errors was determined. The data entry error rate was 0.103% (12 of 11651 points). This was considered to be low enough to forego further manual confirmation. The data was considered to be accurate enough for data analysis. The data was then analyzed using descriptive statistics and Pearson's Chi-square tests.

3.3 - Results

From the sample population of 667 a total of 304 surveys were received for data collection, which produced a response rate of 45.58%. Nine respondents were in "full-time academic" positions, 17 reported as "not practicing", and 278 orthodontists were currently practicing. Key demographic data is located in Table 3.1 and comprehensive data describing the characteristics of the survey respondents is presented in Appendix E.

A total of 76.6% of orthodontists reported having Internet access at work. In addition to this another 12.4 % reported accessing the Internet from a different location. Therefore, 89.0% of orthodontists in Canada have access to the Internet.

Analysis of socio-economic factors related to Internet usage in orthodontic offices revealed significant positive correlations for 2 categories. There was an

association found between Internet usage and staff size ($p < .001$) and case starts ($p = .003$) using Pearson's Chi-Square test (Table 3.2). Other patterns were seen in the descriptive data, located in Table 3.2, but were not statistically significant.

Age vs. Internet

The age of practicing orthodontists ranged from 29 to 73 years of age. A total of 86.6% of orthodontists under the age of 40 reported having Internet access at work. This amount decreased to 72.6% in the 50 and older category, but the association between age and Internet use ($p = .090$) was not statistically significant.

Similarly, the range of years of practice of the respondents was between 1 and 46 years of practice. In this instance, 81.9% of the orthodontists with less than 10 years of experience reported having the Internet in their offices while only 72.7% of the orthodontists 30 or more years of practice reported having the Internet. Once again, the association between the two variables was of no statistical significance ($p = .443$).

Location vs. Internet

Survey responses were received from all of the provinces in Canada except Newfoundland, where only 4 orthodontists are reported to be practicing, and the territories. Not considering Newfoundland and the territories (North West Territories, Nunavut, and Yukon), provincial location appears to be of no importance in regards to Internet use as all of the provinces reported Internet access above 70%. In Nova Scotia, only 1 of the 8 respondents (12.5%) indicated that they did not have computers in their practice. Due to the small sample population and response rate in some provinces it was not possible to calculate a Pearson's Chi-square test.

The population of the city or town was not associated with any statistically significant differences in Internet use ($p = .687$). Descriptively, offices situated in locations of more than 1 million people reported the lowest frequency of Internet use (70.7%). Offices in locations between 100,000 and 499,999 people reported the highest incidence of Internet access at 80%.

Office size vs. Internet

Offices with more staff use the Internet more than those with fewer staff. Offices with 9 or more staff had Internet access at work 94.4% of the time while only

54.9% of offices with less than 5 staff members had Internet access at work. The association between number of staff and Internet access was statistically significant to $p < .0001$.

Although not statistically significant ($p = .212$), descriptively the more hours an orthodontist works the more likely they are to have an Internet connection. Only 66.7% of orthodontists working 3 days or less per week had the Internet compared to 81.0% with orthodontists who worked more than 4 days per week.

Practice production, based on the number of case starts per year has a statistically significant relationship to office Internet use. In offices where the orthodontist starts 300 cases or more, 88.2% had Internet access. This steadily decreased to 60.0% in offices that started less than 100 cases per year. This was significant to $p = .003$.

3.4 - Discussion

Based on the findings of this research a profile of an Internet user in the orthodontic profession can be developed. Although some of the characteristics did not reach statistical significance, descriptively they mirror many of the socio-economic factors seen in the general public. As these characteristics are identified, efforts can be made in order to target and assist those who desire and are in need of assistance in incorporating telecommunication technology into their offices.

Descriptively, age and years of orthodontic practice seem to be factors related to Internet usage. Although the association was not statistically significant, the trend seen in the slow but steady decrease in Internet access, as it relates to an increase in age, is consistent with other findings. The ADA research shows a gradual but steady decline in Internet access at work in the age categories from under 40 to 60 and older [3]. The North American public has also reported that increase in age has a negative relationship to Internet use [1 2]. It seems apparent to assume that this relationship would not be exclusive to the orthodontic profession. As with any new technology the younger generations seem to be quicker to understand and apply them. It might be expected that as time goes on, age will become a less important indicator of Internet usage as the technology would have filtered through all of the generations.

As expected in a population that has a minimum post-graduate level education requirement, over three fourths of orthodontists had Internet access at work and an additional 12.4% had access at a different location. The total for Internet access among Canadian orthodontists is 89.0%. This is reflective of a highly educated population, which would be expected to have a relatively high level of Internet usage. In 2000, the comparative dental group reported that 56.4% had the Internet at work, 90.6% had access at home, and another 1.7% specified access from another location or from a wireless connection [3]. Similarly in 2000, The North Americans with a minimum of a university or bachelors degree reported having Internet access in 79.3% of Canadian homes and 66.0% in U.S. homes [1 2].

Individuals in the general population located in urban or metropolitan areas have tended to be greater Internet users than those in rural or non-metropolitan areas [1 2]. Because orthodontic offices are for the most part located in urban or metropolitan centers data comparison was not expected to show differences between offices located in differently populated centers. This was in fact the case. There was no descriptive or statistical significance in the relationship between the population of the center in which the office is located and computer use. Obviously, part of the issue relates to Internet availability in remote or rural locations. In some more remote locations, Internet access may not yet be available. Because orthodontic offices are typically located in more densely populated areas, Internet availability should not be a factor. In fact, none of the orthodontists who reported that they did not have access to the Internet stated that it was because they were located in a remote location and the service was unavailable.

Similarly, even though Statistics Canada information has shown differences in inter-provincial Internet usage this did not seem to be a significant factor when applied to orthodontist's Internet use. Due to the small amount of orthodontists in some of the provinces, it was difficult to obtain statistically significant information but descriptively there was no apparent relationship between province location and Internet use. In fact, some of the data was opposite of what is seen in the general population, in that orthodontists from Alberta, British Columbia, and Ontario reported less Internet access than their colleagues from other provinces [1].

Economic factors are also used to evaluate population research on Internet usage. Statistics Canada and the U.S. Census Bureau use $80,000 CAN and $75,000 US respectively as their upper limit for their household income groupings. Based on ADA Survey Center research the average net income for orthodontists from their primary private practice in 1998 was $223,730 US. This would indicate that in all probability the majority of practicing orthodontists would fall into the highest end of the household income categories. Orthodontists' Internet use was comparable to or slightly higher than that of the high income general public [1 2 4].

Since net income may not relate directly to practice size, total number of staff, hours of work per week and orthodontic case starts were the practice factors used to assess practice size. Based on number of staff and case starts results, it appears that larger orthodontic practices use the Internet more than smaller orthodontic practices. It is however difficult to say what may be the reason for the relationship.

3.5 - Conclusions

- There is no statistical significance between an orthodontists' age or years of practice and Internet use.
- Orthodontists' Internet access is similar to or slightly higher than the university educated general population.
- Most orthodontic offices are located in urban locations and no relationship was found between population size and office Internet access.
- There is no apparent inter-provincial difference in Internet access.
- Larger orthodontic offices, which have more staff and treat more cases, have a greater frequency of Internet access.

3.6 – Chapter 3 Tables and Figures

Table 3.1: Key demographic data of survey respondents.

Characteristic	*n*	
Age	268	Mean - 47.4 years SD – 9.3 years Range = 29 – 73
Years practicing orthodontics	274	Mean – 15.9 years SD – 9.4 years Range = 1 – 46
Province of primary practice	275	
British Columbia	58	21.1 %
Alberta	46	16.7 %
Saskatchewan	6	2.2 %
Manitoba	9	3.3 %
Ontario	100	36.4 %
Quebec	41	14.9 %
New Brunswick	6	2.2 %
Prince Edward Island	1	.4 %
Nova Scotia	8	2.9 %
Newfoundland	0	0 %
Population of community of primary practice	275	
Less than 100,000	99	36.0 %
100,000 - 499,999	65	23.6 %
500,000 – 999,999	69	25.1 %
1,000,000 or more	42	15.3 %
Total number of staff	270	Mean – 7.9 SD – 6.7
Hours worked in the average week	266	
Less than 16	8	3.0 %
17 – 24	22	8.2 %
25 – 32	120	44.9 %
33 – 40	105	39.7 %
40 or more	11	4.1 %
Case starts per year	260	
Less than 100	30	11.5 %
100 – 199	81	31.2 %
200 – 299	81	31.2 %
300 – 399	38	14.6 %
400 or more	30	11.5 %

Table 3.1: Key demographic descriptive data of survey respondents (cont.)

Modem/Internet connection	269	
Yes	206	76.6 %
No	63	23.4 %

Total *n* varies due to non-responses. Maximum total *n* = 284

Table 3.2 Key descriptive data and crosstabulations by Modem/Internet Connection

	Modem/Internet Connection	
	Yes	No
Age	$n = 262$	
Less than 40 yrs of age	58 86.6%	9 13.4%
40-49 yrs of age	62 75.6%	20 24.4%
50 yrs of age and older	82 72.6%	31 27.4%
Pearson's Chi-square test Asymp. Sig. (2-sided)	$p = .090$	
Years of orthodontic practice	$n = 267$	
Less than 10 years	68 81.9%	15 18.1%
10-19 years	66 78.6%	18 21.4%
20-29 years	56 71.8%	22 28.2%
30 or more years	16 72.7%	6 27.3%
Pearson's Chi-square test Asymp. Sig. (2-sided)	$p = .443$	
Population of primary practice location	$n = 269$	
0 to 99,999	73 75.3%	24 24.7%
100,000 to 499,999	52 80.0%	13 20.0%
500,000 to 999,999	52 78.8%	14 21.2%
1,000,000 or more	29 70.7%	12 29.3%
Pearson's Chi-square test Asymp. Sig. (2-sided)	$p = .687$	

Table 3.2 Key descriptive data (cont.)

	Yes		No
Provincial location of practice		$n = 269$	
AB	36 81.8%		8 18.2%
BC	45 77.6%		13 22.4%
MB	7 77.8		2 22.2%
NB	5 83.3%		1 16.7%
NS	8 100.0%		0 0%
ON	69 71.1%		28 28.9%
PEI	1 100.0%		0 0%
QC	29 72.5%		11 27.5%
SK	6 100.0%		0 0%
Pearson's Chi-square test Asymp. Sig. (2-sided)		$p = .491$	
Total number of staff		$n = 264$	
Less than 5	39 54.9%		32 45.1%
5 to 8	79 76.0%		25 24.0%
9 or more	84 94.4%		5 5.6%
Pearson's Chi-square test Asymp. Sig. (2-sided)		$p < .0001$	
Hours worked in the average week		$n = 266$	
0 to 24 hours	20 66.7%		10 33.3%
25 to 32 hours	90 75.0%		30 25.0%
33 or more hours	94 81.0%		22 19.0%
Pearson's Chi-square test Asymp. Sig. (2-sided)		$p = .212$	

Table 3.2 Key descriptive data (cont.)

	Yes		No
Case starts per year		$n = 259$	
Less than 100	18 60.0%		12 40.0%
100 – 199	54 67.5%		26 32.5%
200 – 299	65 80.2%		16 19.8%
300 or more	60 88.2%		8 11.8%
Pearson's Chi-square test Asymp. Sig. (2-sided)		$p = .003$	

3.7 – Bibliography

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Chapter Four

Perceptions and Attitudes of Canadian Orthodontists' Regarding Digital and Electronic Technology

Perceptions and Attitudes

4.1 - Introduction

Change more often than not faces adversity. As computer and telecommunication technology has gained acceptance in orthodontic offices, it has not been without resistance. Many obstacles need to be identified and overcome. These obstacles can be physical/technical barriers or psychosocial barriers in the form of perceptions and attitudes. In order for new technologies to be implemented they must gain acceptance by the population they have been designed to assist.

The dental profession, in general, does not view telecommunication technology as a high research priority. More important are issues related to treatment techniques and dental materials [1]. It has also been determined that the areas of practice which cause the most concern and stress to orthodontists are issues related to time-management and patient cooperation. In addition to this, the least satisfying aspects of orthodontics are practice management issues and lack of personal time [2]. Therefore, if orthodontists can perceive value in computer and telecommunication technology because of its ability to improve treatment and/or practice efficiency, then there will be a greater chance of more generalized acceptance.

Unfortunately, some perceive that computer technology decreases efficiency. This in part due to the fact that they feel that the time to learn how to use a new technology will detract from their current practice production. They may also feel that their current way of providing a service is adequate and that there is no reason to change.

Although many practitioners view computers in a positive light, there are specific barriers to its implementation. These issues relate to privacy, the doctor-patient relationship, cost, time, and training [3]. Other obstacles to telecommunication technology in the orthodontic office include: inter-participant software incompatibility, patient privacy issues, unclear association and governmental regulations, interference with the patient-practitioner relationship, unclear fee for service or remuneration guidelines, and lack of acceptance for reimbursement by insurance providers. [4 5 6]

United Kingdom (UK) orthodontic consultants were surveyed regarding teledentistry conferencing to provide orthodontic advice to general dental practitioners (GDP). Nearly two-thirds of the consultants were interested in providing an electronic diagnostic service to their local GDPs while only 20% were not interested. The results also showed that 70% were in favor of further research into providing orthodontic advice by electronic means [7]. The time it took to prepare a case was the major obstacle and the main source of negative opinions. Some GDPs claimed the time to prepare the case for a teledentistry conference took more time than conventional means [8 9].

As computers and digital and electronic media become increasingly more common in orthodontic offices, practitioners will need to take initiative in aligning themselves with what the technology has to offer. They must develop the foresight to see how their practices will be affected but also how they can benefit from implementing electronic technology [10].

By establishing current perceptions and attitudes of orthodontists in regards to electronic and digital information, the profession will be able to plan for future acceptance and implementation of the technology. It will assist orthodontists in knowing how they compare with the rest of the profession so that they can investigate continuing education possibilities and technological updates to their practices.

The objectives of this study were:

1. To determine orthodontists' perceptions of digital and electronic media's ability to resolve or improve upon orthodontic practice issues.
2. To determine orthodontists' attitudes towards usefulness of and willingness to use digital and electronic media.
3. To determine the perceived obstacles to the use of digital and electronic media in orthodontic offices.
4. To determine orthodontists' attitudes toward Internet privacy issues.

4.2 - Methods

4.2.1 - Survey Instrument

A research tool consisting of a mail out questionnaire was developed to survey orthodontists in Canada. The purpose of the survey was to obtain information related

to the usage of computers and of digital and electronic technology in the practice of orthodontics. Three categories were developed and consisted of: 1) demographic and practice characteristics, 2) office computer usage, and 3) perceptions and attitudes.

The perceptions and attitudes section was used to evaluate current orthodontic issues and the abilities related to digital and electronic media. Questions related to the ability of the technology to resolve issues, motivation for using the technology, willingness to use the technology, and potential obstacles to its usage.

The thesis committee (2 practicing orthodontists, an informatics consultant, and a sociologist) developed the initial survey. Questions were compiled and arranged in order to assist in gathering information relevant to the issues at hand. A draft survey was then distributed to a pilot group consisting of three practicing orthodontists. Minor revisions were made based on the feedback obtained, in order to produce the final draft. The protocol for the study was approved by the Health Research Ethics Board at the University of Alberta (Appendix A). The final version of the survey (Appendix B) was then distributed to the mailing list.

4.2.2 - Survey Distribution

2003 provincial registries were used to compile a mailing list of Canadian orthodontists. Two orthodontists were excluded due to their involvement in the development of the research tool. The remaining 687 orthodontists became the sample population for the study.

A packet was distributed which consisted of the survey questionnaire, a return self-addressed stamped envelope and an introduction letter (Appendix C) to explain the research topic and to obtain informed consent from the participating orthodontists. Reminder cards (Appendix D) were mailed out one week and three weeks following the initial mail out. The reminder cards were mailed to the sample population thanking them for their participation or reminding to complete the questionnaire and to return the survey.

Thirty-four mail-out packets were returned to sender due to incorrect addresses. Other directories such as AAO and CAO web-site directories were checked in order to obtain up to date addresses. Of the 34, updated addresses were located for 14 orthodontists and the surveys were redistributed. The individuals for

whom no current address was available were considered not to be practicing and were thus removed from the sample population. The total number of surveys mailed to orthodontists came to 667.

4.2.3 - Data Analysis

Survey responses were entered into spreadsheets and coded for data analysis. The results were manually entered into a personal computer. The data was cleaned by checking for any entries outside of the legitimate range or inconsistent codes and the necessary corrections were made by manually rechecking the surveys. SPSS 11.5 for Windows (SPSS Inc., Chicago, IL) was used to enter and analyzed the data. Twenty percent of the surveys were selected, using a random number generator, to be hand checked by a third party to determine the rate of data entry errors. The data entry error rate was 0.103% (12 of 11651 points). This was considered to be accurate enough and further manual confirmation was foregone. The data was therefore considered to be accurate enough for data analysis. Descriptive statistics were used to analyze the data.

4.3 – Results

From the total sample population of 667, a total of 304 surveys were returned for data collection, producing a response rate of 45.58%. Of the respondents 9 were in "full-time academic" positions, 17 reported as "not practicing", and 278 orthodontists were currently practicing.

Capabilities of technology

Ninety percent of orthodontists indicated that computer technology was capable of improving on conventional means of practice with the exceptions of: decreasing office expenses, improving diagnosis and treatment planning, increasing the number of case starts, decreasing appointment times, and increasing patient satisfaction. In fact, 27.9% of orthodontists felt that it was *not at all capable* of decreasing office expenses or of increasing case starts. Even more orthodontists (33.0%) believed that digital and electronic technology was incapable of decreasing appointment times. Conversely, most of the orthodontists reported that they felt that it was *quite capable or very capable* of reducing record storage requirements (96.3%)

and of reducing records transfer time (96.3%). Comprehensive descriptive data is presented in Figure 4.1.

Usefulness of technology

Figure 4.2 illustrates that 4.0% percent or less of orthodontists considered digital photography, digital radiography, and orthodontic imaging software as being *not at all useful*. Over three-fourths of respondents said that digital photography was *quite useful* or *very useful*. With regard to electronic or virtual models and electronic referral forms, two-thirds believed that they were *somewhat useful or useful* and 15% or more said they were *quite or very useful*.

Willingness to use technology

Respondents were asked to report their willingness to use digital and electronic media in various communication settings. The results are recorded in Figure 4.3. Almost two-thirds of the orthodontists (73.6%) *agreed or strongly agreed* with using digital and electronic technology to consult with other dental specialists such as oral surgeons, periodontists, prosthodontists, etc. Slightly less agreed with using it to consult with other orthodontists and about one half of the orthodontists would use it to consult with general practicing dentists. Even less (37.4%) were willing to consult with patients using the technology.

Obstacles

Figure 4.4 illustrates how orthodontists rate various obstacles to the general use of electronic and digital media in their own practices. Cost or expense of the technology was the most important, as over half of the respondents (54.4%) reported it to be a *significant obstacle* or an *insurmountable obstacle*. More than one-third of the respondents responded that security and privacy and scheduling for videoconferencing were *significant obstacles* or *insurmountable obstacles*. Obstacles that were not perceived to be significant included inter-provincial legislation, unclear consult remuneration guidelines, and lack of comfort with technology. Approximately one-third of the respondents considered these to be *not at all an obstacle*.

4.4 - Discussion

Due to the nature of the data collected, descriptive statistics was used to interpret the data set. As previously noted, in order for something new to gain general acceptance it would likely require a perceived value that might allow for improvement upon a current way of doing things. Although, the respondents felt that the technology was useful to the practice of orthodontics, there were many who did not feel that it was capable of improving upon certain aspects of the practice of orthodontics. Many of these issues pertain to some of the greatest sources of stress and concern to orthodontists. The areas of office expense, appointment times, case starts, and patient satisfaction are related to time-management, patient cooperation, practice management, and lack of personal time, all of which are issues related to orthodontists' stress and personal satisfaction [2]. In contrast though, 95.9% of respondents did report that they felt that the technology was at least *somewhat capable* of increasing practice efficiency and 90.0% thought that it was at least *somewhat capable* of increasing practice production. It appears that although orthodontists identify some positive opportunity, they are not able to relate the opportunities to specific practice issues such as increasing case starts, reducing appointment times and reducing office expenses. Specific research to investigate how information technology might benefit these issues would likely motivate orthodontists to actively integrate the technologies.

Further to this, by and large orthodontists consider digital and electronic technology to be useful to their orthodontic practices. The equipment, which is considered to be the most useful to orthodontists, is digital photography. Only 2 of 272 respondents considered it to be *not at all useful*. Digital photography has a generalized perception of value to the orthodontic community. Digital radiography and imaging software are also perceived to be useful to a large majority of the profession.

By and large, orthodontists were open to the idea of using telecommunications as a means of communication in their practices. It appears that they are more open to communicating with colleagues than they are willing to communicate with the public or with patients. This is reflective of other research which shows that practitioners

are leery about using digital and electronic technology to communicate with the public, while on the other hand they are quite open to the idea of using it to communicate with colleagues [7].

Obstacles, which impede the acceptance of digital and electronic media in the general dental community include cost, lack of comfort with technology, privacy, time, software incompatibility, unclear guidelines, interference with patient-practitioner relationships, and lack of remuneration guidelines [3 4]. It appears that some of these same obstacles are also viewed as obstacles to the orthodontic community. Lack of comfort, security, and time seemed to be the major obstacles to the general incorporation of digital and electronic technology. In contrast to previous studies, remuneration guidelines and lack of comfort with technology did not seem to be considered as important to the orthodontic community as one might have thought.

In general, the profession seems to view the technology as a useful product even though they may not see it as something that can improve their office efficiency or production. Orthodontists are sensitive to some of the potential obstacles but have a willingness to overcome these and incorporate the technology into the practice of orthodontics.

4.5 - Conclusions

- Digital and electronic technology is generally viewed as useful to the orthodontic profession.
- Orthodontists, in general, do not believe the technology is capable of increasing office efficiency and/or production
- The majority of orthodontists are more willing to implement digital and electronic technology in consulting with colleagues than in consulting with patients.
- The major obstacles to the general use of the technology are related to cost, security or privacy, and time management.

4.6 – Chapter 4 Tables and Figures

Figure 4.1

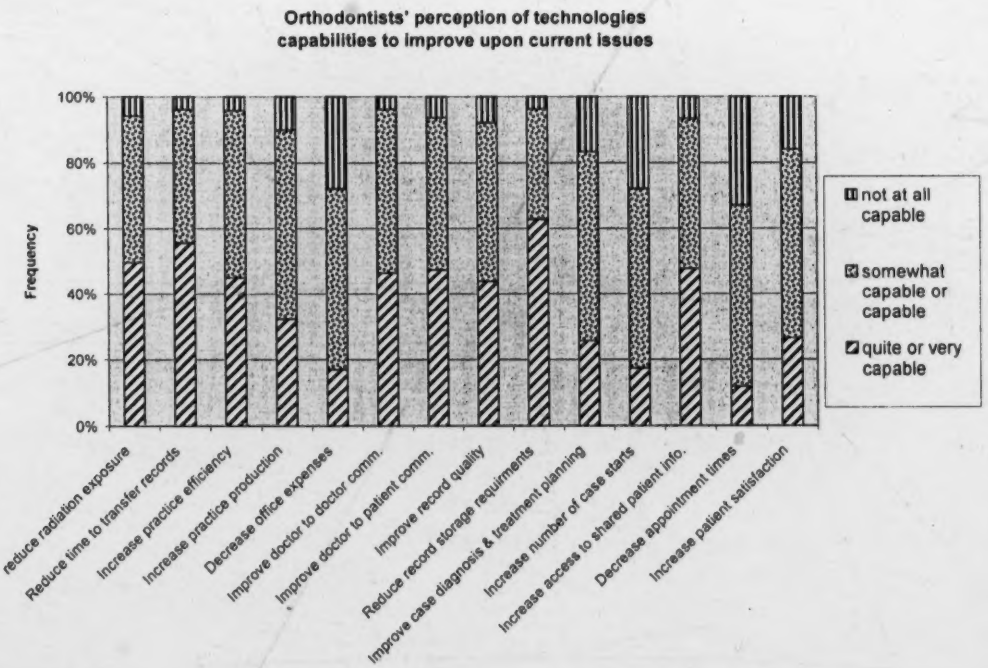


Figure 4.2

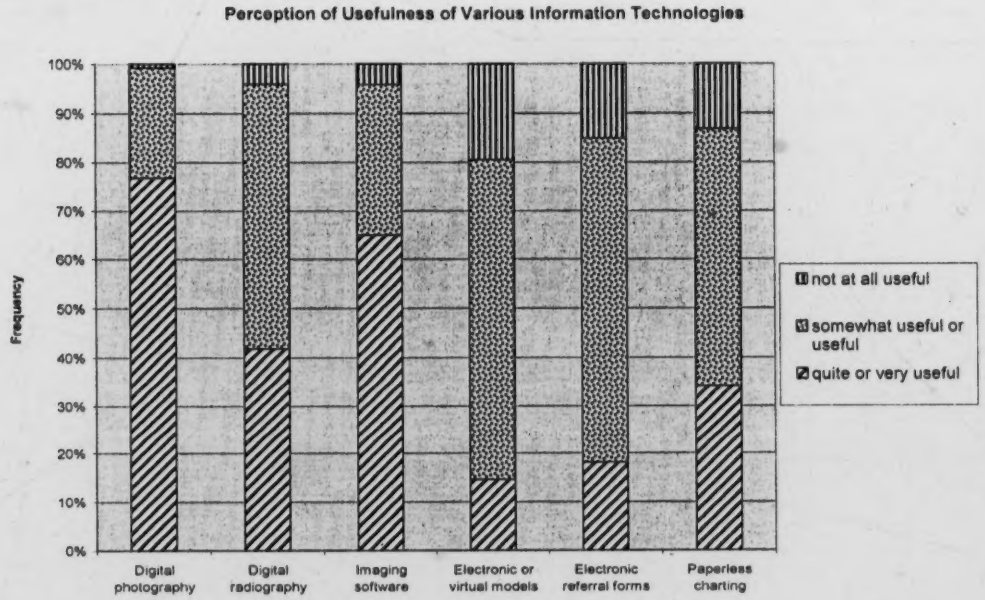


Figure 4.3

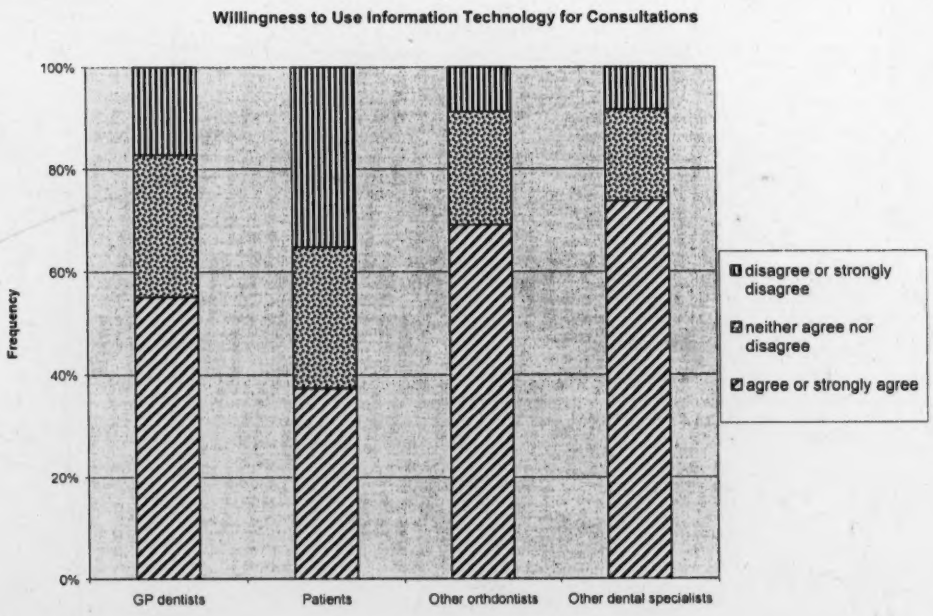
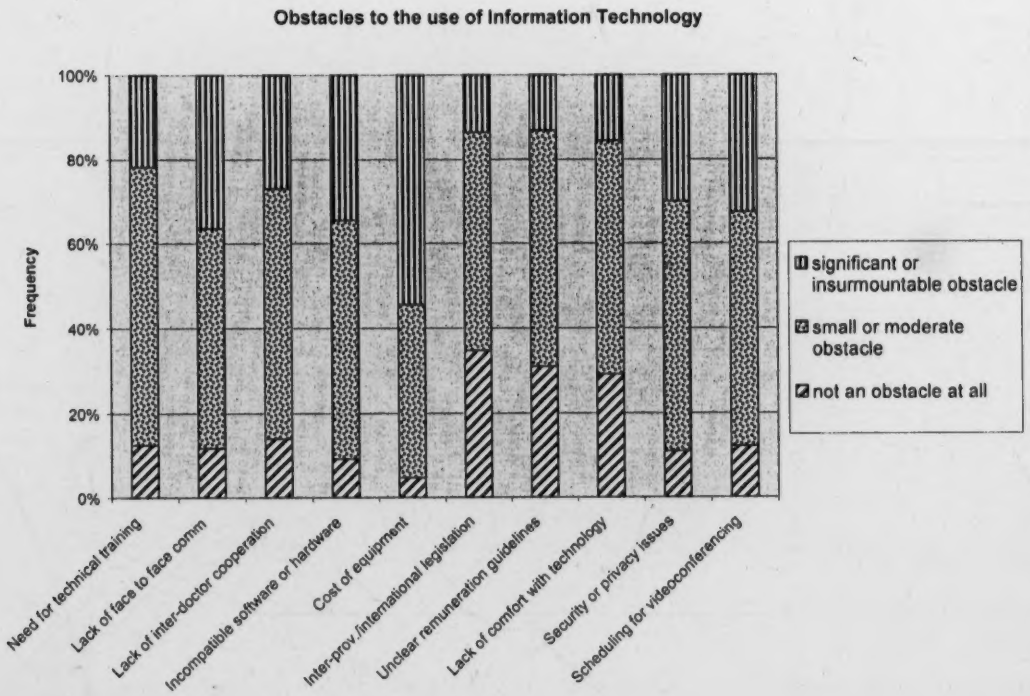


Figure 4.4



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Chapter Five
General Discussion

5.1 – Discussion and Answers to Research Questions

The purpose of this research project was to obtain descriptive data relative to the use of digital and electronic media by Canadian orthodontists. This was accomplished by using an anonymous, self-administered, mail-out survey distributed to orthodontists in Canada. Due to the lack of existing data specific to the topic, data representative of the North American general public and American dentists was used for baseline information. The goal of the research was to develop a better understanding of where the profession stands in regards to the capabilities, usage, attitudes, and perceptions of Canadian orthodontists in regards to digital and electronic media such as the Internet, digital imaging (photography and radiography), computer use, and many other computer related issues.

Research Question #1 – What is the frequency of computer and Internet use among orthodontists?

The first step in assessing digital and electronic information usage is to determine the current relevant usage trends and frequencies. This study was able to determine that computer use amongst orthodontists is high. Almost all of the orthodontists in Canada use computers in their offices. In fact only 2 of the 275 respondents reported that they did not have a computer in their primary office.

Internet use was also relatively high among orthodontists in Canada. The majority of orthodontists reported having Internet access in their offices and even more reported having access at another location. There also appears to be an emerging trend toward "high-speed" or broadband Internet access. This is encouraging because it seems that most of the orthodontists have the basic necessities for information technology and communication to be an integral part of the way or profession communicates. Of those who reported not having in office Internet access, the most frequent reported reason was for "privacy or security concerns."

Research Question #2 - What are computers and the Internet primarily used for in orthodontic practices?

The most frequently reported tasks for which computers were used are:

1 – Accounting/billing/bookkeeping

2 – Scheduling

3 – Communicating with patients

It is apparent from these findings that orthodontic office computers are primarily being used for administrative duties. The amount of clinical application of computers in the practice of orthodontics is comparably low. This would indicate that there is still a long way to go before computers and information technology are incorporated into the every day practice of clinical orthodontics. Similarly, the Internet typically was not used for direct clinical applications other than obtaining information on products.

Research Question #3 – How does computer and Internet use among orthodontists compare to the dental profession and to the general public?

While the dental population of America reported slightly less computer and Internet use in 2000, one would expect that these numbers would have increased over the last 3 years. Therefore, although orthodontists may be more inclined to have in office computers and Internet access, compared to the general population, the difference is likely not significant.

When compared to the general population, orthodontists were more likely to have Internet access than the North American public. Furthermore, when compared to their likely socioeconomic counterparts it appears as though orthodontists may still tend to have a greater amount of Internet access.

Research Question #4 – Is there a statistically significant association between orthodontist's age or experience and Internet use?

The survey collected information on both chronological age as well as years of orthodontic practice. Descriptively, age and years of orthodontic practice may be factors related to Internet usage. Although the association was not statistically significant ($p = .090$), the decrease in Internet access, as it relates to age, is consistent with other sources findings. The descriptive trends appear to be similar to those seen in the general public and the dental profession [1 2 3]. That is that younger orthodontists (86.6% under 40) tend to be more likely to have access to the Internet than older orthodontists (71.4% 60 and older). A similar result was seen in relation to years of orthodontic practice.

Research Question #5 – Is there a statistically significant association between orthodontic practice location and Internet use?

Data was collected from a wide variety of locations in Canada. Responses were obtained from every province in Canada with the exception of Newfoundland. Analysis of the data revealed that there was no association between the population of the area in which a practice is located or the province in which it is located. The lack of association may be due to the fact that population and Internet use is typically divided into urban and rural [2 3]. For the most part, orthodontics, as a specialty service, is unlikely be available in rural areas. Therefore there would be a minimal chance of orthodontists not having Internet access due to the remoteness of their practice location. This was in fact the case, as none of the respondents reported that the service was unavailable due to the remote location of their office.

The lack of association between provincial location and Internet use may be due to the fact that other factors weigh more heavily than provincial location. For example, other socioeconomic and demographic factors such as income, education, age, etc., may have overshadowed any trends seen in Statistics Canada information which indicates differences in inter-provincial Internet access [2].

Research Question #6 – Is there a statistically significant association between orthodontic practice size and Internet use?

Due to the sensitivity of asking for gross or net income of a practice or an individual, the indicators of staff size, hours of practice per week, and case starts per year were used to help determine practice size. From these indicators statistically significant associations to Internet use were found with staff size and case starts per year. Therefore it would appear that larger orthodontic practices have in office Internet access more often than smaller orthodontic offices.

It is difficult, however, to compare these findings with similar findings in the general North American population. Because one would assume that the majority of orthodontists fall in the maximum net household income group of the general population research, it does not allow for a comparison. Although the general trend is for Internet use to increase as income increases, extrapolation of this data to the orthodontic population is not feasible

Research Question #7 – What are orthodontists' perceptions of the capabilities of digital and electronic media to improve the practice of orthodontics?

As information technology progresses, it will have more and more to offer to the orthodontic profession. In general, the technology is viewed as being capable of improving the way orthodontics is practiced. Unfortunately, this favorable view when analyzed more specifically showed that orthodontists did not have a clear understanding of what the technology has to offer them in order to improve those things which matter most. The vast majority of respondents reported that the technology was able to increase practice efficiency and production but they did not perceive that it would be able to improve on issues which are most directly related to the stress and concerns of orthodontists[4]. Furthermore, they do not relate how the technology is capable of improving specific practice building indicators.

It is possible that some of what digital and electronic technology has to offer is not yet fully understood by orthodontists. Part of the challenge will be making them aware of the benefits of the technology. On the other hand, the majority of orthodontists are quite pleased with their profession and their lives [4]. For these individuals they simply may not see the need of incorporating new things into an already rewarding profession and lifestyle.

Research Question #8 – What are orthodontists' perceptions of how useful digital and electronic media is to the practice of orthodontics?

Generally speaking, orthodontists feel that digital and electronic technologies are useful to the practice of orthodontics. Electronic models, electronic referral forms, and paperless charting were not perceived to be as useful to the practice of orthodontics as were digital photography, digital radiography, and imaging software. Orthodontists almost unanimously (270 of 272) agreed that digital photography was at least somewhat useful to the practice of orthodontics.

It seems that there is a lag between the perception of how useful digital radiography is to orthodontics and the incorporation of the technology into orthodontic practices. When considering that the most significant obstacle to the use of digital and electronic technology is related to the cost of the equipment, this may help answer the question of 'why don't more orthodontists have digital radiography in

their offices?' It is likely that as the cost of digital radiography goes down that more and more orthodontists will invest in this technology.

Research Question #9 – What are orthodontists' attitudes towards using digital and electronic communication in the practice of orthodontics?

More than half of the orthodontists reported being open to the concept of using digital and electronic communication in order to consult with GP dentists, orthodontic colleagues, and other dental specialists. Fewer orthodontists were willing to consult with patients using the technology. It appears that most orthodontists are willing to consult with other dental specialists or other orthodontists even more so than GP dentists. Perhaps this is due to the convenience of information technology and its advantages over traditional communication methods, while the disadvantages or limitations of the media are perhaps what inhibit orthodontists' willingness to use the media to consult with GP dentists and patients.

Viewed in light of the finding that orthodontists view security, privacy and lack of face-to-face communication as obstacles to the use of digital and electronic media, it seems as though one of the fears of using this technology is that information will be misunderstood. In an increasingly litigious society, informed consent has become paramount in ensuring that the practice of orthodontics be conducted without unnecessary complications. This may explain why orthodontists feel most comfortable communicating electronically with orthodontic colleagues and other dental specialists. There may be a mutual respect or understanding beyond that of the lay person which adds comfort to the possibility of this type of communication between dental colleagues.

Research Question #10 – What are orthodontists' perceptions towards obstacles to the use of digital and electronic media in the practice of orthodontics?

The incorporation of information technology into the practice of orthodontics faces many obstacles. The area of most concern was related to the cost of equipment. No matter how useful a technology may be, if it is unreasonably priced then it will be difficult for it to be put into general use. Research has been done to investigate the cost effectiveness of Telehealth applications. Findings have had mixed conclusions regarding whether or not Telehealth is economically more advantageous than

traditional means of communication [5-8]. Unfortunately, the majority of this research has been conducted in publicly run health care systems which do not directly translate into privately delivered fee-for-service orthodontic services.

Orthodontists are also concerned with obstacles that relate to the handling of patient information. Security and privacy and lack of face-to-face communication were viewed to be an obstacle to some degree by over 85% of the respondents. Conversely those things which were viewed to be less of an obstacle had to do with legislation and remuneration guidelines and lack of current comfort with the new technology. In the end, it appears that those things which will need to be accomplished to see information technology become more widely used are decreasing cost and improving the quality and privacy of the communication. It is interesting to note however that while legislation is not considered to be an obstacle, the government exerts much authority over security and privacy issues.

Another difficult obstacle to over come will be the problem of incompatible software and computers. The issue has existed since the dawn of computers and remains an important obstacle in all areas of information technology. While there may be a few more popularly used orthodontic software programs, it will become increasingly more important that as more programs become available that the consumers, the orthodontists, exert pressure on the suppliers to ensure that the various software programs have a measure of compatibility.

5.2 – Major Conclusions

Based on the results of this study, the following major conclusions were made:

- The vast majority of orthodontist offices are equipped with computers which are primarily used for administrative tasks and, to a lesser extent, clinical tasks.
- Internet access is quite common in orthodontic offices but the major reasons for not having access are security and privacy concerns.
- Orthodontic offices with more staff and which treat more cases have a statistically significant association with Internet access.

- Age, years of practice, and practice location, have no apparent statistically significant association with orthodontic office Internet use.
- The profession generally views digital and electronic technology as being useful in the practice of orthodontics but it does not see that it is capable of improving areas of practice which are the most important to orthodontists.
- Orthodontists, in general, are willing to use digital and electronic technology to consult with colleagues but are less willing to do so with patients.
- The greatest obstacles to the general use of digital and electronic technology are related to cost, security or privacy, and time management.

5.3 – Limitations

When considering the results of the survey, there are several items which must be taken into consideration. These can include methodology as well as analysis and interpretation of the data.

Based on the response rate, assumptions are made that the results are representative of the entire population. It is, however, even more difficult to make assumptions into another population. For example, to what degree can one use the results of this survey to reflect the trends in North America? There are differences that exist in Canadian and American general populations with regards to Internet use [2] [3]. Therefore, one must assume that even though these differences may be small that the results may not be an accurate representation of the trends in the United States.

Computer and Internet use was based solely on the respondents reporting that they had Internet available to them or in other words that they had an in office Internet connection. There was no report of how frequently the service was used and thus one cannot entirely assume that just because an individual reports having an Internet connection that they use the Internet.

Limitations also existed in the depth to which the topic was able to be investigated. Due to the lack of previous research into this area it was necessary to compare results to the general public and to the dental profession. The results from these other populations were limited to descriptive statistics.

Although the results did not deviate grossly from the general public and dental profession results, it is possible that in a self administered questionnaire that the

respondents did not answer truthfully. In fact, one respondent reported in their comments that they felt that their results should not be included because they would not report what they perceived the study was trying to determine. Furthermore, there is a risk that a respondent may unknowingly report how they would like things to be rather than how they really are.

It is possible as well that there may have been some confusion with respect to the difference between having an in office modem connection and in office Internet access. The difference between the two was not clarified in the survey. Fortunately, there was only a difference of 1.6% between the two resultant frequencies.

There were also some differences in how questions were worded which made it difficult to directly compare the results to other survey results. For example, respondents were asked to "circle all that apply" in reference to the question, "Which of the following people use a computer for office related work?" In the ADA survey, respondents which asked to circle the one individual who primarily used the computer [1]. In addition to this, because of differences in the practice of orthodontics and general dentistry not all of the tasks and applications were exactly the same. Therefore some interpretation was required in order to be able to compare the results.

5.4 – Future Studies

Much research remains to be done in regards to assessing, directing, and implementing information technology into the practice of orthodontics. As previously mentioned, this was the first study of the orthodontic profession to assess where the community stands as a whole on the related issues and current trends.

Now that baseline descriptive data has been obtained, future research can be conducted in order to further the use of information technology in orthodontics. Research related to how information technology can help improve the way orthodontics is practiced would likely motivate orthodontists to actively integrate the use of the technology into their practices. In order for this to occur it will be necessary to see that it is able to make improvements in the areas which are of greatest importance to orthodontists.

Research and strategies will need to be developed in order to solve privacy and security issues. Research will also need to be conducted in the area of cost

effectiveness and software compatibility specific to the orthodontic profession. As these obstacles are better understood, the likelihood of implementation of telehealth practices will increase. As methods of improving practice efficiency are developed, orthodontists will be more willing to accept the expense of the technology.

The question then arises as to why bigger offices have the Internet? Is it because, assuming bigger offices are more efficient, it is an efficiency tool. Do they have Internet access because bigger offices need the Internet or because the Internet allows them to have more staff or treat more cases? The potential of the Internet is looming over us ready to be discovered. Research into how the profession can strategically implement its use will allow for a more efficient and controlled integration into the practice of orthodontics.

5.5 – Final Comments

A substantial amount of interest in the topic was expressed in the comments of the survey respondents. Some of the respondents expressed how much easier their lives have become while others expressed frustration with its use and implementation. Nonetheless, information technology is permeating almost every corner of our society and the practice of orthodontics is no exception. It is possibly naïve to think that digital and electronic media will not be a part of the future of orthodontics but as security and privacy issues heighten it will be necessary that measures are taken to ensure proper implementation of legislation and protocol.

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Appendices

Appendix A: Ethics approval

Health Research Ethics Board

[illegible]

UNIVERSITY OF ALBERTA HEALTH SCIENCES FACULTIES,
CAPITAL HEALTH AUTHORITY, AND CARITAS HEALTH GROUP

HEALTH RESEARCH ETHICS APPROVAL

Date of HREB Meeting:	March 7, 2003
Name of Applicant:	Dr. Neal Palmer & Dr. Paul Major
Organization:	University of Alberta
Department:	Dentistry, Graduate Orthodontics
Project Title:	**Electronic and Digital Information Usage Among Canadian Orthodontists**

The Health Research Ethics Board (HREB) has reviewed the protocol for this project and found it to be acceptable within the limitations of human experimentation. The HREB has also reviewed and approved the subject information letter and consent form, if applicable.

The approval for the study as presented is valid for one year. It may be extended following completion of the yearly report form. Any proposed changes to the study must be submitted to the Health Research Ethics Board for approval. Written notification must be sent to the HREB when the project is complete or terminated.

Dr. Sharon Warren
Chair of the Health Research Ethics Board
(B: Health Research)

File number: B-080303-DENT

University of Alberta · Capital Health · Caritas Health Group

Appendix B: Electronic and Digital Information Usage Survey – Page 1

Electronic and Digital Information Usage

Please complete the following questionnaire by filling in the blank or by circling the number next to the appropriate answer. Please answer all of the questions to the best of your knowledge and ability. Your responses will remain anonymous.

Section I: Demographics

1) Are you currently practicing orthodontics?
   1. No ⟶ If "No", please circle the corresponding number to the left and return the survey.
   2. Yes

2) Which of the following describes your primary practice or position?
   1. Solo Practice
   2. Associateship
   3. Partnership
   4. Group practice / cost sharing
   5. Full time academic ⟶ Please circle the appropriate response to the left and return the survey.
   6. Other: please specify _____

3) What year were you born? _____.

4) How many years have you practiced orthodontics?
   (Please exclude years spent in graduate orthodontic training)

   _____ years.

5) Where is your primary practice located?

   _____, _____
   (city/town) (province/territory)

Appendix B: Electronic and Digital Information Usage Survey – Page 2

6) How many of each of the following types of auxiliaries is employed at your practice (please include both primary and satellite practice totals)?

Reception / Secretarial Staff _____
Patient-care Coordinators _____
Business Managers _____
Chair-side Staff _____
Laboratory Technicians _____

7) Do you have a computer(s) in your primary practice?
   1. No …then proceed to question #27
   2. Yes

8) Do you practice at a secondary or satellite location(s)?
   1. No ⟶ If "No", please circle the corresponding number to the left and proceed to question # 11.
   2. Yes

9) Where is your satellite practice(s) located?

a) _____ (city/town), _____ (province/territory)

b) _____ (city/town), _____ (province/territory)

10) If you have a satellite practice, do you have a computer(s) in your satellite practice?
   1. No
   2. Yes

11) In the past 12 months, in an average week, how many hours per week do you practice orthodontics?
   1. < 16 hours/week
   2. 17 – 24 hours/week
   3. 25 – 32 hours/week
   4. 33 – 40 hours/week
   5. > 40 hours/week

12) In the past 5 years, what is your best estimate of your total annual case starts?
   1. < 100
   2. 100 – 199
   3. 200 – 299
   4. 300 – 399
   5. ≥ 400

Appendix B: Electronic and Digital Information Usage Survey – Page 3

Section II: Office Computer Usage

13) Which of the following people use a computer for office related work? (Circle the number of all that apply)
1. Receptionist/secretary
2. Business staff
3. Chair-side staff
4. Orthodontist
5. Other: please specify _____

14) Which of the following imaging software programs do you currently use? (Select only one)
1. Dolphin
2. Vistadent
3. Quickceph
4. Dentofacial Planner
5. Other: _____
6. Do not use imaging software
7. Don't know

15) Which of the following charting methods do you use? (Select only one)
1. Paper chart
2. Electronic (paperless) chart
3. Combination of both

16) For which of the following tasks does your staff, excluding yourself, use a computer? (Circle the number of all that apply)

1. Processing insurance claims
2. Accounting/Billing/Bookkeeping
3. Communicating with patients
4. Scheduling
5. Digital Imaging
6. Education/Training
7. Internet: email, World Wide Web
8. Electronic referral form
9. Diagnosis/Treatment planning
10. Monitoring inventory
11. Communicating with doctors
12. Charting/Records
13. Practice Management
14. Virtual Models (Emodels, Orthocad)
15. None
16. Other: _____

Appendix B: Electronic and Digital Information Usage Survey – Page 4

17) For which of the following tasks do you, personally, use a computer? (Circle the number of all that apply)

1. Processing insurance claims
2. Accounting/Billing/Bookkeeping
3. Communicating with patients
4. Scheduling
5. Digital Imaging
6. Education/Training
7. Internet: email, World Wide Web
8. Electronic referral form
9. Diagnosis/Treatment planning
10. Monitoring inventory
11. Communicating with doctors
12. Charting/Records
13. Practice Management
14. Virtual Models (Emodels, Orthocad)
15. None
16. Other: _____

18) Which of the following computer related equipment do you have in your practice? (Circle the number of all that apply)

1. Modem/Internet connection
2. CD-ROM drive
3. Scanner
4. Digital photography
5. DVD drive
6. Digital Radiography
7. Sound card
8. Graphics card
9. CD writer
10. Color printer
11. Don't know
12. None

19) What type of Internet connection do you have in your primary practice?

1. None
2. Dial-up / telephone line (28K, 56K)
3. High speed / Broadband (Cable Modem, ADSL, etc.)
4. Other: _____
5. Don't know

20) Will you be upgrading your Internet access in the next twelve months?

1. No
2. Yes; Upgrading to Dial-Up
3. Yes; Upgrading to high speed
4. Don't know

Appendix B: Electronic and Digital Information Usage Survey – Page 5

21) If you do not have an Internet connection in your office, what are your reasons for not having access to the Internet?
(Circle the number of all that apply)

1. Not applicable, already have Internet access
2. Too costly (service or equipment)
3. Internet or computers too difficult to use
4. Use a computer at a different location to access Internet
5. No need / not useful
6. Not enough time
7. Cannot obtain access due to remote location of office
8. Confidentiality, privacy, or security concerns
9. Computer too old
10. Waiting for installation
11. Computer not capable
12. No interest
13. Other: (specify)_____
14. Don't know

For questions #20-26: **Over the last year...**	Daily	Weekly	Monthly	Quarterly	Never
22) How often do you communicate by e-mail concerning diagnosis and/or treatment planning issues with...?					
a) A GP **dentist**.....	1	2	3	4	5
b) An **orthodontist** colleague.....	1	2	3	4	5
c) **Other dental specialist** (oral surgeon, periodontist, prosthodontist, etc.).....	1	2	3	4	5
d) A **patient** or patient's guardian.....	1	2	3	4	5
23) How often do you communicate by e-mail concerning treatment progress of a patient with...?					
a) A GP **dentist**.....	1	2	3	4	5
b) An **orthodontist** colleague.....	1	2	3	4	5
c) **Other dental specialist** (oral surgeon, periodontist, prosthodontist, etc.).....	1	2	3	4	5
d) A **patient** or patient's guardian.....	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 6

	Daily	Weekly	Monthly	Quarterly	Never
a) A GP **dentist**.....	1	2	3	4	5
b) An **orthodontist** colleague.....	1	2	3	4	5
c) **Other dental specialist** (oral surgeon, periodontist, prosthodontist, etc.).....	1	2	3	4	5
d) A **patient** or patient's guardian.....	1	2	3	4	5
24) How often do you <u>confirm patient appointments</u> by e-mail?	1	2	3	4	5
25) How often do you or your office staff use the Internet for the following applications?					
a) Obtaining diagnostic information.....	1	2	3	4	5
b) Buying dental products.....	1	2	3	4	5
c) Obtaining product information or support.....	1	2	3	4	5
d) Participating in continuing education.....	1	2	3	4	5
e) Practice marketing (i.e. office Web page).....	1	2	3	4	5
f) Reading electronic dental journals.....	1	2	3	4	5
g) Participating in dental chat groups/rooms.....	1	2	3	4	5
h) Receiving electronic referral forms.....	1	2	3	4	5
i) Sending electronic referral forms.....	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 7

Section III: Perceptions and Attitudes

26) Presently, how important are the following items to you in your orthodontic practice?	Not at all important	Somewhat important	Important	Quite important	Very important
a) Reduce radiation exposure.....	1	2	3	4	5
b) Reduce time to transfer records.....	1	2	3	4	5
c) Increase practice efficiency.....	1	2	3	4	5
d) Increase practice production.....	1	2	3	4	5
e) Decrease office expenses.....	1	2	3	4	5
f) Improve doctor-to-doctor communication.....	1	2	3	4	5
g) Improve doctor to patient communication.....	1	2	3	4	5
h) Improve record quality.....	1	2	3	4	5
i) Reduce record storage requirements.....	1	2	3	4	5
j) Improve case diagnosis and treatment planning....	1	2	3	4	5
k) Increase number of case starts.....	1	2	3	4	5
l) Increase access to shared patient information (i.e. radiographs, medical history, etc.).....	1	2	3	4	5
m) Decrease appointment times.....	1	2	3	4	5
n) Increase patient satisfaction.....	1	2	3	4	5

27) How would you personally rate the following motivators for implementation of electronic and digital technology in your own practice?	Not at all important	Somewhat important	Important	Quite important	Very important
a) Intrinsic (i.e. personal satisfaction or interest).....	1	2	3	4	5
b) Monetary (i.e. improve office efficiency and/or office production).....	1	2	3	4	5
d) Extrinsic (i.e. outside pressure from orthodontic community requires it in order to keep up).....	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 8

28) How do you view digital and electronic technology's capability to…?	Not at all capable	Somewhat capable	Capable	Quite capable	Very capable
a) Reduce radiation exposure	1	2	3	4	5
b) Reduce time to transfer records	1	2	3	4	5
c) Increase practice efficiency	1	2	3	4	5
d) Increase practice production	1	2	3	4	5
e) Decrease office expenses	1	2	3	4	5
f) Improve doctor-to-doctor communication	1	2	3	4	5
g) Improve doctor to patient communication	1	2	3	4	5
h) Improve record quality	1	2	3	4	5
i) Reduce record storage requirements	1	2	3	4	5
j) Improve case diagnosis and treatment planning	1	2	3	4	5
k) Increase number of case starts	1	2	3	4	5
l) Increase access to shared patient information (i.e. radiographs, medical history, etc.)	1	2	3	4	5
m) Decrease appointment times	1	2	3	4	5
n) Increase patient satisfaction	1	2	3	4	5

29) How useful do you view the following technologies to the practice of orthodontics?	Not at all useful	Somewhat useful	Useful	Quite useful	Very useful
a) Digital photography	1	2	3	4	5
b) Digital radiography	1	2	3	4	5
c) Imaging software (e.g. Dolphin, Quickceph, Vistadent, etc.)	1	2	3	4	5
d) Electronic or virtual models (e.g. Emodels, Orthocad, etc.)	1	2	3	4	5
e) Electronic referral forms	1	2	3	4	5
f) Paperless charting	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 9

30) There is an emerging trend towards consultations using digital and electronic media (email, video conferencing, digital photos, and digital radiographs) via the Internet …	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a) I am willing to use this sort of technology in consulting with GP dentists?.....	1	2	3	4	5
b) I am willing to use this sort of technology in consulting with patients?.....	1	2	3	4	5
c) I am willing to use this sort of technology in consulting with orthodontists?.....	1	2	3	4	5
d) I am willing to use this sort of technology in consulting with other dental specialists (i.e. oral surgeon, periodontist, prosthodontist, etc.)?.....	1	2	3	4	5

31) How would you rate the following as obstacles to the general use of electronic and digital media in your orthodontic practice?	Not at all an obstacle	Small obstacle	Moderate obstacle	Significant obstacle	Insurmountable obstacle
a) Need for technical training.....	1	2	3	4	5
b) Lack of face-to-face communication.....	1	2	3	4	5
c) Lack of inter-doctor cooperation.....	1	2	3	4	5
d) Incompatible computer software and/or hardware.....	1	2	3	4	5
e) Cost/expense of equipment.....	1	2	3	4	5
f) Inter-provincial/international legislation.....	1	2	3	4	5
g) Unclear consult remuneration guidelines.....	1	2	3	4	5
h) Lack of comfort with technology.....	1	2	3	4	5
i) Security or privacy issues.....	1	2	3	4	5
j) Scheduling for videoconferencing.....	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 10

32) How would you rate the following as obstacles to the general use of electronic and digital media in the orthodontic profession in general?	Not at all an obstacle	Small obstacle	Moderate obstacle	Significant obstacle	Insurmountable obstacle
a) Need for technical training.....	1	2	3	4	5
b) Lack of face-to-face communication.....	1	2	3	4	5
c) Lack of inter-doctor cooperation.....	1	2	3	4	5
d) Incompatible computer software and/or hardware.....	1	2	3	4	5
e) Cost/expense of equipment.....	1	2	3	4	5
f) Inter-provincial/international legislation.....	1	2	3	4	5
g) Unclear consult remuneration guidelines.....	1	2	3	4	5
h) Lack of comfort with technology.....	1	2	3	4	5
i) Security or privacy issues.....	1	2	3	4	5
j) Scheduling for videoconferencing.....	1	2	3	4	5

33) How concerned are you about security in relation to your office financial transactions conducted over the Internet (for example purchasing products over the Internet using a credit card or banking over the Internet)?

1. Not at all concerned
2. Concerned
3. Very concerned
4. Don't know

34) How concerned are you about security in relation to transfer of patient personal and treatment information conducted over the Internet?

1. Not at all concerned
2. Concerned
3. Very concerned
4. Don't know

Appendix B: Electronic and Digital Information Usage Survey – Page 11

35) When writing a treatment plan letter to a dental colleague, how important do you view the following items?	Not at all important	Somewhat important	Important	Quite important	Very important
a) Patient personal information (i.e. address, date of birth, etc.)	1	2	3	4	5
b) Orthodontic examination date	1	2	3	4	5
c) Review of problem list	1	2	3	4	5
d) Statement of diagnosis	1	2	3	4	5
e) Statement of treatment plan	1	2	3	4	5
f) Estimated treatment length	1	2	3	4	5
g) Indication of treatment to be delivered by the dental colleague	1	2	3	4	5

36) When receiving a treatment plan letter from an orthodontist, how important do you think dental colleagues view the following items?	Not at all important	Somewhat important	Important	Quite important	Very important
a) Patient personal information (i.e. address, date of birth, etc.)	1	2	3	4	5
b) Orthodontic examination date	1	2	3	4	5
c) Review of problem list	1	2	3	4	5
d) Statement of diagnosis	1	2	3	4	5
e) Statement of treatment plan	1	2	3	4	5
f) Estimated treatment length	1	2	3	4	5
g) Indication of treatment to be delivered by the dental colleague	1	2	3	4	5

Appendix B: Electronic and Digital Information Usage Survey – Page 12

Thank you again for taking the time to complete this questionnaire. Your comments are welcome and space has been provided below if you would like to share any thoughts or ideas relating to the topic. **Please return the survey in the envelope provided.**

Please indicate if you would like to receive a summary of the results of this study.

☐ **Yes**, please send me a summary of the results.

☐ **No**, I will look for the published results.

Comments:

Neal G. Palmer, D.D.S
Graduate Orthodontic Program
1048 Dentistry/Pharmacy bldg.
University of Alberta
Edmonton, Alberta
Canada
T6G 2N8

Appendix C: Sample introduction letter

Dr. «First_Name» «Last_Name» December 4, 2003
«Address»
«City», «Province»
«Postal_Code»

Dear Dr. «Last_Name»;

I am writing you to ask for your assistance with an important research project. The title of the project is "**Electronic and Digital Information Usage among Canadian Orthodontists**." I am distributing the survey to all practicing orthodontists in Canada. Your address was obtained from the listings published by your respective provincial regulatory body.

E-mail, the Internet, and digital radiography are changing the way we practice orthodontics and manage our practices. The purpose of this research project is to compile and assess the current attitudes, capabilities, trends, and understanding of orthodontists towards the use of electronic and digital information, the Internet, and e-mail. By responding to this survey it will allow us to better determine where the profession stands with respect to this rapidly changing media and what plans can be made for future implementation.

The survey will take about 20 minutes to complete. Your participation is voluntary and you may refrain from responding to questions if you wish. Your responses are anonymous. You can request a summary of the results of the project by checking the box on the last page of the survey.

The study is being performed through the University of Alberta Graduate Orthodontic Program in partial fulfillment of my Masters of Science thesis requirements. My research supervisor is Dr. Paul Major, Program Director. The project is sponsored by the McIntyre Fund of the University of Alberta and the University of Alberta Fund for Dentistry. In accordance with University of Alberta regulations, all original surveys will be maintained in a secure area for a minimum of five years following the completion of the project.

If you have any questions or comments I can be reached through the Graduate Orthodontic Program at (780) 492-4469, or through e-mail at npalmer@ualberta.ca. If you have any concerns about this research project, you may contact the Associate Dean and Department Chair of the Department of Dentistry, Dr. G. Wayne Raborn at (780) 492-3312.

Sincerely,

Dr. Neal G. Palmer, D.D.S.
Graduate Orthodontic Resident

Appendix D: Sample reminder card

Reminder Card

Dear Doctor,

Hello again! Recently, you were sent a survey evaluating **Digital and Electronic Information Usage**. I am sending this reminder because I have not received your survey.

If you have already returned your survey, I would like to thank you for your assistance in assuring quality research data.

If you have not yet returned the survey, I would like to encourage you to do so. Each survey returned will increase the accuracy and reliability of the results. We appreciate your willingness to help and thank you for completing the survey. If you are in need of another copy of the survey, or if you have any questions or comments, I can be reached at (780) 492-4469 or at npalmer@ualberta.ca.

Thank you again for your assistance.

Dr. Neal G. Palmer, D.D.S
University of Alberta
Graduate Orthodontics

Appendix E: Complete Descriptive Data of Survey Respondents.

Characteristic	*n*	
Age	268	Mean - 47.4 years SD – 9.3 years
Years practicing orthodontics	274	Mean – 15.9 years SD – 9.4 years
Province of primary practice	275	
British Columbia	58	21.1 %
Alberta	46	16.7 %
Saskatchewan	6	2.2 %
Manitoba	9	3.3 %
Ontario	100	36.4 %
Quebec	41	14.9 %
New Brunswick	6	2.2 %
Prince Edward Island	1	.4 %
Nova Scotia	8	2.9 %
Newfoundland	0	0 %
Population of community of primary practice	275	
Less than 100,000	99	36.0 %
100,000 - 499,999	65	23.6 %
500,000 – 999,999	69	25.1 %
1,000,000 or more	42	15.3 %
Primary type of practice	284	
Solo Practice	186	65.5 %
Associateship – associate	23	8.1 %
Partnership	27	9.5 %
Group Practice	38	13.4 %
Academic	9	3.2 %
Other	1	0.4 %
Total number of staff	270	Mean – 7.9 SD – 6.7
Satellite practice	269	
No	165	61.3 %
Yes	104	38.7%

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Hours worked in the average week	267	
Less than 16	8	3.0 %
17 – 24	22	8.2 %
25 – 32	120	44.9 %
33 – 40	1.6	39.7 %
40 or more	11	4.1 %
Case starts per year	260	
Less than 100	30	11.5 %
100 – 199	81	31.2 %
200 – 299	81	31.2 %
300 – 399	38	14.6 %
400 or more	30	11.5 %
Computers in primary practice	272	
No	7	2.6 %
Yes	265	97.4 %
Computers in satellite practice	105	
No	27	25.7 %
Yes	78	74.3 %
Staff Computer Use		
Receptionist/Secretary	268	
Yes	264	98.5 %
No	4	1.5 %
Business Staff	268	
Yes	171	63.8 %
No	97	36.2 %
Chair-side Staff	268	
Yes	163	60.8 %
No	105	39.2 %
Orthodontist	268	
Yes	218	81.3 %
No	50	18.7 %
Other	267	
Yes	27	10.1 %
No	240	89.9 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Software Programs	267	
Dolphin	48	18.0 %
Vistadent	29	10.5 %
Quickceph	32	12.0 %
Dentofacial Planner	22	8.2 %
Other	57	21.3 %
Do not use imaging software	75	28.1 %
Don't know	5	1.9 %
Charting Method	268	
Paper chart	175	65.3 %
Electronic chart	33	12.3 %
Combination	60	22.4 %
Computer tasks by staff		
Processing insurance claims	268	
Yes	166	61.9 %
No	102	38.1 %
Accounting/billing/bookkeeping	268	
Yes	247	92.2 %
No	21	7.8 %
Communication with patients	268	
Yes	196	73.1 %
No	72	26.9 %
Scheduling	268	
Yes	222	82.8 %
No	46	17.2 %
Digital imaging	268	
Yes	164	61.2 %
No	104	38.8 %
Education/training	268	
Yes	91	34.0 %
No	177	66.0 %
Internet: email, www	268	
Yes	123	45.9 %
No	145	54.1 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Electronic referral form	268	
Yes	17	6.3 %
No	251	93.7 %
Diagnosis and treatment planning	268	
Yes	91	34.0 %
No	177	66.0 %
Monitoring Inventory	268	
Yes	45	16.8 %
No	223	83.2 %
Communication with doctors	268	
Yes	145	52.7 %
No	123	45.9 %
Charting/records	268	
Yes	89	33.2 %
No	179	66.8 %
Practice Management	268	
Yes	142	53.0 %
No	126	47.0 %
Virtual Models	268	
Yes	6	2.2 %
No	262	97.8 %
None	268	
Yes	1	0.4 %
No	267	99.6 %
Other	268	
Yes	8	3.0 %
No	260	97.0 %
Computer tasks by orthodontist		
Processing insurance claims	269	
Yes	4	1.5 %
No	265	98.5 %
Accounting/billing/bookkeeping	269	
Yes	54	20.1 %
No	215	79.9 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Communication with patients	269	
Yes	110	40.9 %
No	159	59.1 %
Scheduling	269	
Yes	36	13.4 %
No	233	86.6 %
Digital imaging	269	
Yes	133	49.4 %
No	136	50.6 %
Education/training	269	
Yes	111	41.3 %
No	158	58.7 %
Internet: email, www	269	
Yes	177	65.8 %
No	92	34.2 %
Electronic referral form	269	
Yes	4	1.5 %
No	265	98.5 %
Diagnosis and treatment planning	269	
Yes	135	50.2 %
No	134	49.8 %
Monitoring Inventory	269	
Yes	14	5.2 %
No	269	94.8 %
Communication with doctors	269	
Yes	134	49.8 %
No	135	50.2 %
Charting/records	269	
Yes	66	24.5 %
No	203	75.5 %
Practice Management	269	
Yes	103	38.3 %
No	166	61.7 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Virtual Models	269	
Yes	8	3.0 %
No	261	97.0 %
None	269	
Yes	20	7.4 %
No	249	92.6 %
Other	269	
Yes	6	2.2 %
No	263	97.8 %
Computer equipment		
Modem/Internet connection	269	
Yes	206	76.6 %
No	63	23.4 %
CD-ROM drive	269	
Yes	243	90.3 %
No	26	9.7 %
Scanner	269	
Yes	179	66.5 %
No	90	33.5 %
Digital photography	269	
Yes	203	75.5 %
No	66	24.5 %
DVD drive	269	
Yes	123	45.7 %
No	146	54.3 %
Digital radiography	269	
Yes	40	14.9 %
No	229	85.1 %
Sound card	269	
Yes	162	60.2 %
No	107	39.8 %
Graphics card	269	
Yes	162	60.2 %
No	107	39.8 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

CD writer	269	
Yes	143	53.2 %
No	126	46.8 %
Color printer	269	
Yes	223	81.1 %
No	46	16.7 %
Don't know	269	
Yes	2	0.7 %
No	267	99.3 %
None	269	
	4	1.5 %
	265	98.5 %
Type of Internet connection	269	
None	67	24.9 %
Dial-up/telephone line (28K, 56K)	72	26.8 %
High-speed/Broadband (Cable, DSL)	126	46.8 %
Other	1	0.4 %
Don't know	3	1.1 %
Upgrading Internet in next 12 months	268	
No	199	74.3 %
Yes, upgrading to dial-up	1	0.4 %
Yes, upgrading to high-speed	28	10.4 %
Don't know	40	14.9 %
Reasons for not having Internet		
Too costly	266	
Yes	5	1.9 %
No	261	98.1 %
Too difficult to use	266	
Yes	0	0 %
No	266	100 %
Access at different location	266	
Yes	33	12.4 %
No	233	87.6 %
No need	266	
Yes	17	6.4 %
No	249	93.6 %

Appendix E: Complete Descriptive Data of Survey Respondents (cont.)

Not enough time	266	
Yes	7	2.6 %
No	259	97.4 %
Location too remote	266	
Yes	0	0 %
No	266	100 %
Security and privacy concerns	266	
Yes	24	9.0 %
No	242	91.0 %
Computer too old	266	
Yes	4	1.5 %
No	262	98.5 %
Waiting for installation	266	
Yes	2	0.8 %
No	264	99.8 %
Computer not capable	266	
Yes	3	1.1 %
No	263	98.9 %
No interest	266	
Yes	14	5.3 %
No	252	94.7 %
Other	266	
Yes	4	1.5 %
No	262	98.5 %
Don't know	266	
Yes	1	0.4 %
No	265	99.6 %

Appendix F: Digital and Electronic Technology Use Ordinal Data

Over the last year…

	n	
Frequency of e-mail concerning diagnosis and/or treatment planning issues		
GP dentist	265	
Daily	7	2.6 %
Weekly	11	4.0 %
Monthly	32	11.6 %
Quarterly	32	11.6 %
Never	183	69.1 %
Orthodontist colleague	268	
Daily	3	1.1 %
Weekly	15	5.5 %
Monthly	45	16.4 %
Quarterly	36	13.4 %
Never	169	63.1 %
Other dental specialist	262	
Daily	3	1.1 %
Weekly	18	6.9 %
Monthly	27	10.3 %
Quarterly	40	15.3 %
Never	174	66.4 %
Patient	261	
Daily	1.5	1.5 %
Weekly	6.5	6.9 %
Monthly	6.9	7.3 %
Quarterly	13.8	14.6 %
Never	66.2	69.7 %
Frequency of e-mail concerning treatment progress		
GP dentist	267	
Daily	2	0.7 %
Weekly	14	5.2 %
Monthly	12	4.5 %
Quarterly	21	7.9 %
Never	218	81.6 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Orthodontist colleague	266	
Daily	0	0 %
Weekly	5	1.9 %
Monthly	11	4.1 %
Quarterly	23	8.6 %
Never	227	85.3 %
Other dental specialist	268	
Daily	1	0.4 %
Weekly	11	4.1 %
Monthly	16	6.0 %
Quarterly	32	11.9 %
Never	208	77.6 %
Patient	266	
Daily	1	0.4 %
Weekly	10	3.8 %
Monthly	10	3.8 %
Quarterly	33	12.4 %
Never	212	79.7 %
Frequency of Internet consult using digital photos and/or radiographs		
GP dentist	264	
Daily	2	0.8 %
Weekly	11	4.2 %
Monthly	20	7.6 %
Quarterly	19	7.2 %
Never	212	80.3 %
Orthodontist colleague	265	
Daily	1	0.4 %
Weekly	10	3.8 %
Monthly	16	6.0 %
Quarterly	26	9.8 %
Never	212	80.0 %
Other dental specialist	263	
Daily	1	0.4 %
Weekly	11	4.2 %
Monthly	16	6.1 %
Quarterly	32	12.2 %
Never	203	77.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Patient	264	
Daily	0	0 %
Weekly	7	2.7 %
Monthly	4	1.5 %
Quarterly	14	5.3 %
Never	239	90.5 %
Frequency of e-mail to confirm patient appointments	265	
Daily	9	3.4 %
Weekly	1	0.4 %
Monthly	6	2.3 %
Quarterly	9	3.4 %
Never	240	90.6 %
Frequency of Internet for the following applications		
Obtaining diagnostic information	261	
Daily	6	2.3 %
Weekly	10	3.8 %
Monthly	18	6.9 %
Quarterly	27	10.3 %
Never	200	76.6 %
Buying dental products	264	
Daily	5	1.9 %
Weekly	28	10.6 %
Monthly	29	11.0 %
Quarterly	43	16.3 %
Never	159	60.2 %
Obtaining product information or support	264	
Daily	4	1.5 %
Weekly	41	15.5 %
Monthly	52	19.7 %
Quarterly	65	24.6 %
Never	102	38.6 %
Participating in continuing education	263	
Daily	3	1.1 %
Weekly	11	4.2 %
Monthly	20	7.6 %
Quarterly	46	17.5 %
Never	183	69.6 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Practice marketing (i.e. office Web page)	265	
Daily	24	9.1 %
Weekly	8	3.0 %
Monthly	10	3.8 %
Quarterly	19	7.2 %
Never	204	77.0 %
Reading electronic dental journals	266	
Daily	2	0.8 %
Weekly	16	6.0 %
Monthly	45	16.9 %
Quarterly	51	16.2 %
Never	152	57.1 %
Participating in dental chat groups/rooms	266	
Daily	8	3.0 %
Weekly	8	3.0 %
Monthly	10	3.8 %
Quarterly	14	5.3 %
Never	226	85.0 %
Receiving electronic referral forms	265	
Daily	2	0.8 %
Weekly	8	3.0 %
Monthly	5	1.9 %
Quarterly	6	2.3 %
Never	244	92.1 %
Sending electronic referral forms	266	
Daily	2	0.8 %
Weekly	4	1.5 %
Monthly	6	2.3 %
Quarterly	6	2.3 %
Never	248	93.2 %
Importance of issues to your orthodontic practice		
Reduce radiation exposure	272	
Not at all important	30	11.0 %
Somewhat important	63	23.2 %
Important	77	28.3 %
Quite important	42	15.4 %
Very important	60	22.1 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Reduce time to transfer records	273	
Not at all important	78	28.6 %
Somewhat important	67	24.5 %
Important	67	24.5 %
Quite important	40	14.7 %
Very important	21	7.7 %
Increase practice efficiency	274	
Not at all important	7	2.6 %
Somewhat important	19	6.9 %
Important	71	25.9 %
Quite important	67	24.5 %
Very important	110	40.1 %
Increase practice production	274	
Not at all important	16	5.8 %
Somewhat important	23	8.4 %
Important	75	27.4 %
Quite important	75	27.4 %
Very important	85	31.0 %
Decrease office expenses	273	
Not at all important	6	2.2 %
Somewhat important	20	7.3 %
Important	70	25.6 %
Quite important	81	29.7 %
Very important	96	35.2 %
Improve doctor-to-doctor communication	274	
Not at all important	11	4.0 %
Somewhat important	20	7.3 %
Important	83	30.3 %
Quite important	90	32.8 %
Very important	70	25.5 %
Improve doctor-to-patient communication	274	
Not at all important	8	2.9 %
Somewhat important	21	7.7 %
Important	78	28.5 %
Quite important	87	31.8 %
Very important	80	29.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Improve record quality	273	
Not at all important	17	6.2 %
Somewhat important	26	9.5 %
Important	74	27.1 %
Quite important	73	26.7 %
Very important	83	30.4 %
Reduce storage requirements	274	
Not at all important	19	6.9 %
Somewhat important	56	20.4 %
Important	66	24.1 %
Quite important	64	23.4 %
Very important	69	25.2 %
Improve case diagnosis & treatment planning	273	
Not at all important	23	8.4 %
Somewhat important	32	11.7 %
Important	71	26.0 %
Quite important	71	26.0 %
Very important	76	27.8 %
Increase number of case starts	269	
Not at all important	25	9.3 %
Somewhat important	32	11.9 %
Important	93	34.6 %
Quite important	66	24.5 %
Very important	53	19.7 %
Increase access to shared patient information	266	
Not at all important	46	17.3 %
Somewhat important	65	24.4 %
Important	97	36.5 %
Quite important	41	15.4 %
Very important	17	6.4 %
Decrease appointment times	270	
Not at all important	23	8.5 %
Somewhat important	47	17.4 %
Important	89	33.0 %
Quite important	70	25.9 %
Very important	41	15.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Increase patient satisfaction	271	
Not at all important	3	1.1 %
Somewhat important	10	3.7 %
Important	39	14.4 %
Quite important	71	26.2 %
Very important	148	54.6 %
Importance of motivators for implementation of electronic and digital technology in your practice		
Intrinsic	273	
Not at all important	28	10.3 %
Somewhat important	34	12.5 %
Important	83	30.4 %
Quite important	71	26.0 %
Very important	57	20.9 %
Monetary	273	
Not at all important	12	4.4 %
Somewhat important	41	15.0 %
Important	108	39.6 %
Quite important	70	25.6 %
Very important	42	15.4 %
Extrinsic	272	
Not at all important	82	30.1 %
Somewhat important	88	32.4 %
Important	77	28.3 %
Quite important	13	4.8 %
Very important	12	4.4 %
Capability of digital and electronic technologies ability to		
Reduce radiation exposure	274	
Not at all important	16	5.8 %
Somewhat important	51	18.6 %
Important	71	25.9 %
Quite important	76	27.7 %
Very important	60	21.9 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Reduce time to transfer records	270	
Not at all important	10	3.7 %
Somewhat important	39	14.4 %
Important	71	26.3 %
Quite important	79	29.3 %
Very important	71	26.3 %
Increase practice efficiency	271	
Not at all important	11	4.1 %
Somewhat important	57	21.0 %
Important	81	29.9 %
Quite important	70	25.8 %
Very important	52	19.2 %
Increase practice production	269	
Not at all important	27	10.0 %
Somewhat important	75	27.9 %
Important	80	29.7 %
Quite important	60	22.3 %
Very important	27	10.0 %
Decrease office expenses	269	
Not at all important	75	27.9 %
Somewhat important	94	34.9 %
Important	54	20.1 %
Quite important	27	10.0 %
Very important	19	7.1 %
Improve doctor-to-doctor communication	271	
Not at all important	10	3.7 %
Somewhat important	61	22.5 %
Important	74	27.3 %
Quite important	79	29.2 %
Very important	47	17.3 %
Improve doctor-to-patient communication	270	
Not at all important	17	6.3 %
Somewhat important	61	22.6 %
Important	64	23.7 %
Quite important	79	29.3 %
Very important	49	18.1 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Improve record quality	270	
Not at all important	21	7.8 %
Somewhat important	58	21.5 %
Important	73	27.0 %
Quite important	68	25.2 %
Very important	50	18.5 %
Reduce storage requirements	269	
Not at all important	10	3.7 %
Somewhat important	34	12.6 %
Important	56	20.8 %
Quite important	78	29.0 %
Very important	91	33.8 %
Improve case diagnosis & treatment planning	270	
Not at all important	45	16.7 %
Somewhat important	76	28.1 %
Important	80	29.6 %
Quite important	42	15.6 %
Very important	27	10.0 %
Increase number of case starts	269	
Not at all important	75	27.9 %
Somewhat important	80	29.7 %
Important	67	24.9 %
Quite important	28	10.4 %
Very important	19	7.1 %
Increase access to shared patient information	268	
Not at all important	18	6.7 %
Somewhat important	47	17.5 %
Important	75	28.0 %
Quite important	74	27.6 %
Very important	54	20.1 %
Decrease appointment times	270	
Not at all important	89	33.0 %
Somewhat important	90	33.3 %
Important	59	21.9 %
Quite important	23	8.5 %
Very important	9	3.3 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Increase patient satisfaction	268	
Not at all important	43	16.0 %
Somewhat important	74	27.6 %
Important	80	29.9 %
Quite important	46	17.2 %
Very important	25	9.3 %
Usefulness of technologies		
Digital photography	272	
Not at all useful	2	0.7 %
Somewhat useful	11	4.0 %
Useful	50	18.4 %
Quite useful	50	18.4 %
Very useful	159	58.5 %
Digital radiography	272	
Not at all useful	11	4.0 %
Somewhat useful	52	19.1 %
Useful	95	34.9 %
Quite useful	62	22.8 %
Very useful	52	19.1 %
Imaging software	269	
Not at all useful	11	4.1 %
Somewhat useful	35	13.0 %
Useful	48	17.8 %
Quite useful	73	27.1 %
Very useful	102	37.9 %
Electronic of virtual models	267	
Not at all useful	52	19.5 %
Somewhat useful	105	39.3 %
Useful	71	26.6 %
Quite useful	29	10.9 %
Very useful	10	3.7 %
Electronic referral forms	271	
Not at all useful	41	15.1 %
Somewhat useful	96	35.4 %
Useful	85	31.4 %
Quite useful	35	12.9 %
Very useful	14	5.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Paperless charting	272	
Not at all useful	36	13.2 %
Somewhat useful	80	29.4 %
Useful	63	23.2 %
Quite useful	51	18.8 %
Very useful	42	15.4 %
Willing to use technology in consulting with		
GP dentist	273	
Strongly disagree	15	5.5 %
Disagree	32	11.7 %
Neither agree nor disagree	76	27.8 %
Agree	117	42.9 %
Strongly agree	33	12.1 %
Patient	273	
Strongly disagree	34	12.5 %
Disagree	62	22.7 %
Neither agree nor disagree	75	27.5 %
Agree	67	24.5 %
Strongly agree	35	12.8 %
Orthodontist	272	
Strongly disagree	8	2.9 %
Disagree	16	5.9 %
Neither agree nor disagree	60	22.1 %
Agree	126	46.3 %
Strongly agree	62	22.8 %
Other dental specialist	273	
Strongly disagree	7	2.6 %
Disagree	16	5.9 %
Neither agree nor disagree	49	17.9 %
Agree	137	50.2 %
Strongly agree	64	23.4 %
Obstacles to the use technology in own practice		
Need for technical training	270	
Not at all an obstacle	34	12.6 %
Small obstacle	75	27.8 %
Moderate obstacle	102	37.8 %
Significant obstacle	57	21.1 %
Insurmountable obstacle	2	0.7 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Lack of face-to-face communication	271	
Not at all an obstacle	32	11.8 %
Small obstacle	53	19.6 %
Moderate obstacle	87	32.1 %
Significant obstacle	84	31.0 %
Insurmountable obstacle	15	5.5 %
Lack of inter-doctor cooperation	263	
Not at all an obstacle	37	14.1 %
Small obstacle	70	26.6 %
Moderate obstacle	85	32.3 %
Significant obstacle	62	23.6 %
Insurmountable obstacle	9	3.4 %
Incompatible software/hardware	269	
Not at all an obstacle	25	9.3 %
Small obstacle	64	23.8 %
Moderate obstacle	87	32.3 %
Significant obstacle	86	32.0 %
Insurmountable obstacle	7	2.6 %
Cost/expense of equipment	272	
Not at all an obstacle	13	4.8 %
Small obstacle	37	13.6 %
Moderate obstacle	74	27.2 %
Significant obstacle	123	45.2 %
Insurmountable obstacle	25	9.2 %
Inter-provincial/international legislation	253	
Not at all an obstacle	88	34.8 %
Small obstacle	74	29.2 %
Moderate obstacle	56	22.1 %
Significant obstacle	28	11.1 %
Insurmountable obstacle	7	2.8 %
Unclear consult remuneration guidelines	255	
Not at all an obstacle	79	31.0 %
Small obstacle	72	28.2 %
Moderate obstacle	70	27.5 %
Significant obstacle	31	12.2 %
Insurmountable obstacle	3	1.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Lack of comfort with technology	270	
Not at all an obstacle	79	29.3 %
Small obstacle	71	26.3 %
Moderate obstacle	78	28.9 %
Significant obstacle	39	14.4 %
Insurmountable obstacle	3	1.1 %
Security or privacy issues	272	
Not at all an obstacle	30	11.0 %
Small obstacle	83	30.5 %
Moderate obstacle	77	28.3 %
Significant obstacle	67	24.6 %
Insurmountable obstacle	15	5.5 %
Scheduling for videoconferencing	263	
Not at all an obstacle	32	12.2 %
Small obstacle	46	17.5 %
Moderate obstacle	99	37.6 %
Significant obstacle	74	28.1 %
Insurmountable obstacle	12	4.6 %
Obstacles to the use of electronic and digital media in orthodontic profession in general		
Need for technical training	262	
Not at all an obstacle	13	5.0 %
Small obstacle	69	26.3 %
Moderate obstacle	107	40.8 %
Significant obstacle	70	26.7 %
Insurmountable obstacle	3	1.1 %
Lack of face-to-face communication	262	
Not at all an obstacle	9	3.4 %
Small obstacle	72	27.5 %
Moderate obstacle	103	39.3 %
Significant obstacle	70	26.7 %
Insurmountable obstacle	8	3.1 %
Lack of inter-doctor cooperation	259	
Not at all an obstacle	11	4.2 %
Small obstacle	65	25.1 %
Moderate obstacle	113	43.6 %
Significant obstacle	66	25.5 %
Insurmountable obstacle	4	1.5 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Incompatible software/hardware	257	
Not at all an obstacle	13	5.1 %
Small obstacle	56	21.8 %
Moderate obstacle	89	34.6 %
Significant obstacle	85	33.1 %
Insurmountable obstacle	14	5.4 %
Cost/expense of equipment	261	
Not at all an obstacle	5	1.9 %
Small obstacle	31	11.9 %
Moderate obstacle	62	23.8 %
Significant obstacle	134	51.3 %
Insurmountable obstacle	29	11.1 %
Inter-provincial/international legislation	250	
Not at all an obstacle	54	21.6 %
Small obstacle	83	33.2 %
Moderate obstacle	68	27.2 %
Significant obstacle	38	15.2 %
Insurmountable obstacle	7	2.8 %
Unclear consult remuneration guidelines	251	
Not at all an obstacle	59	23.5 %
Small obstacle	79	31.5 %
Moderate obstacle	71	28.3 %
Significant obstacle	35	13.9 %
Insurmountable obstacle	7	2.8 %
Lack of comfort with technology	259	
Not at all an obstacle	25	9.7 %
Small obstacle	50	19.3 %
Moderate obstacle	96	37.1 %
Significant obstacle	78	30.1 %
Insurmountable obstacle	10	3.9 %
Security or privacy issues	259	
Not at all an obstacle	21	8.1 %
Small obstacle	54	20.8 %
Moderate obstacle	86	33.2 %
Significant obstacle	82	31.7 %
Insurmountable obstacle	16	6.2 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Scheduling for videoconferencing	253	
Not at all an obstacle	20	7.9 %
Small obstacle	46	18.2 %
Moderate obstacle	34	37.2 %
Significant obstacle	80	31.6 %
Insurmountable obstacle	13	5.1 %
Concern for security of financial transactions conducted over the Internet	273	
Not at all concerned	58	21.2 %
Concerned	149	54.6 %
Very concerned	62	22.7 %
Don't know	4	1.5 %
Concern for security of patient record or personal information transferred over the Internet	273	
Not at all concerned	54	19.8 %
Concerned	145	53.1 %
Very concerned	68	24.9 %
Don't know	6	2.2 %
Importance of information in letter to dental colleague		
Patient personal information	274	
Not at all important	17	6.2 %
Somewhat important	50	18.2 %
Important	76	27.7 %
Quite important	53	19.3 %
Very important	78	28.5 %
Orthodontic examination date	274	
Not at all important	11	4.0 %
Somewhat important	60	21.9 %
Important	94	34.3 %
Quite important	52	19.0 %
Very important	57	20.8 %
Review of problem list	272	
Not at all important	1	0.4 %
Somewhat important	6	2.2 %
Important	57	21.0 %
Quite important	80	29.4 %
Very important	128	47.1 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Statement of diagnosis	273	
Not at all important	1	0.4 %
Somewhat important	5	1.8 %
Important	47	17.2 %
Quite important	82	30.0 %
Very important	138	50.5 %
Statement of treatment plan	272	
Not at all important	2	0.7 %
Somewhat important	9	3.3 %
Important	48	17.6 %
Quite important	81	29.8 %
Very important	132	48.5 %
Estimated treatment length	274	
Not at all important	11	4.0 %
Somewhat important	73	26.6 %
Important	92	33.6 %
Quite important	57	20.8 %
Very important	41	15.0 %
Indication of treatment to be delivered	274	
Not at all important	3	1.1 %
Somewhat important	17	6.2 %
Important	72	26.3 %
Quite important	55	20.1 %
Very important	127	46.4 %
Importance of information in letter to dental colleague		
Patient personal information	271	
Not at all important	21	7.7 %
Somewhat important	56	20.7 %
Important	84	31.0 %
Quite important	41	15.1 %
Very important	69	25.5 %
Orthodontic examination date	270	
Not at all important	28	10.4 %
Somewhat important	75	27.8 %
Important	84	31.1 %
Quite important	41	15.2 %
Very important	42	15.6 %

Appendix F: Digital and Electronic Technology Use Ordinal Data (cont.)

Review of problem list	270	
Not at all important	3	1.1 %
Somewhat important	26	9.6 %
Important	74	27.4 %
Quite important	82	30.4 %
Very important	85	31.5 %
Statement of diagnosis	271	
Not at all important	2	0.7 %
Somewhat important	20	7.4 %
Important	74	27.3 %
Quite important	82	30.3 %
Very important	93	34.3 %
Statement of treatment plan	271	
Not at all important	4	1.5 %
Somewhat important	20	7.4 %
Important	62	22.9 %
Quite important	77	28.4 %
Very important	108	39.9 %
Estimated treatment length	271	
Not at all important	19	7.0 %
Somewhat important	68	25.1 %
Important	75	27.7 %
Quite important	57	21.0 %
Very important	52	19.2 %
Indication of treatment to be delivered	265	
Not at all important	3	1.1 %
Somewhat important	26	9.8 %
Important	57	21.5 %
Quite important	60	22.6 %
Very important	119	44.9 %

Appendix G: Internet Use Versus Demography Crosstabulations

Age versus Internet Use			Internet		Total
			Yes	No	
Age in years	Less than 40	Count	58	9	67
		%	86.6%	13.4%	100.0%
	40-49	Count	62	20	82
		%	75.6%	24.4%	100.0%
	50 or older	Count	82	31	113
		%	72.6%	27.4%	100.0%
Total		Count	202	60	262
		%	77.1%	22.9%	100.0%

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.820	2	0.090

Years of orthodontic practice versus Internet Use			Internet		Total
			Yes	No	
Years of orthodontic practice	Less than 10	Count	68	15	83
		%	81.9%	18.1%	100.0%
	10 to 19	Count	66	18	84
		%	78.6%	21.4%	100.0%
	20 to 29	Count	56	22	78
		%	71.8%	28.2%	100.0%
	30 or more	Count	19	6	22
		%	72.7%	27.3%	100.0%
Total		Count	206	61	267
		%	77.2%	22.8%	100.0%

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.684	3	0.443

Appendix G: Internet Use Versus Demography Crosstabulations (cont.)

Provincial location of primary practice versus Internet Use			Internet		Total
			Yes	No	
Provincial location of primary practice	Alberta	Count	36	8	44
		%	81.8%	18.2%	100.0%
	British Columbia	Count	45	13	58
		%	77.6%	22.4%	100.0%
	Manitoba	Count	7	2	9
		%	77.8%	22.2%	100.0%
	New Brunswick	Count	5	1	6
		%	83.3%	16.7%	100.0%
	Newfoundland	Count	N/A	N/A	N/A
		%			
	Nova Scotia	Count	8	0	8
		%	100.0%	0%	100.0%
	Ontario	Count	69	28	97
		%	71.1%	28.9%	100.0%
	P.E.I.	Count	1	0	1
		%	100.0%	0%	100.0%
	Quebec	Count	29	11	40
		%	72.5%	27.5%	100.0%
	Saskatchewan	Count	6	0	6
		%	100.0%	0%	100.0%
Total		Count	206	63	269
		%	76.6%	23.4%	100.0%

Population of primary practice location versus Internet Use			Internet		Total
			Yes	No	
Population of primary practice location	0 to 99,999	Count	73	24	97
		%	75.3%	24.7%	100.0%
	100,000 to 499,999	Count	52	13	65
		%	80.0%	20.0%	100.0%
	500,000 to 999,999	Count	52	14	66
		%	78.8%	21.2%	100.0%
	1,000,000 or more	Count	29	12	41
		%	70.7%	29.3%	100.0%
Total		Count	206	63	269
		%	76.6%	23.4%	100.0%

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.480	3	0.687

Appendix G: Internet Use Versus Demography Crosstabulations (cont.)

Case starts per year versus Internet Use			Internet		Total
			Yes	No	
Case starts per year	Less than 100	Count	18	12	30
		%	60.0%	40.0%	100.0%
	100 to 199	Count	54	26	80
		%	67.5%	32.5%	100.0%
	200 to 299	Count	65	16	81
		%	80.2%	19.8%	100.0%
	300 or more	Count	60	8	68
		%	88.2%	11.8%	100.0%
Total		Count	197	62	259
		%	76.1%	23.9%	100.0%

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.785	3	0.003

Hours of Practice per week versus Internet Use			Internet		Total
			Yes	No	
Hours of practice per week	Less than 25	Count	20	10	30
		%	66.7%	33.3%	100.0%
	25-32	Count	90	30	120
		%	75.0%	25.0%	100.0%
	33 and over	Count	94	22	116
		%	81.0%	19.0%	100.0%
Total		Count	204	62	266
		%	76.7%	23.3%	100.0%

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.103	2	0.212